THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXX. No. 756.] LONDON, NOVEMBER 6, 1877. [29th Year.] Price 6d.

ESTABLISHED 1782.

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ERECTED BY

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BIRMINGHAM: 9 to 15, New Bartholomew Street.
WEST BROMWICH: Royal Eagle Tube-Works.
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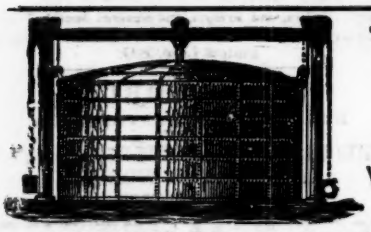

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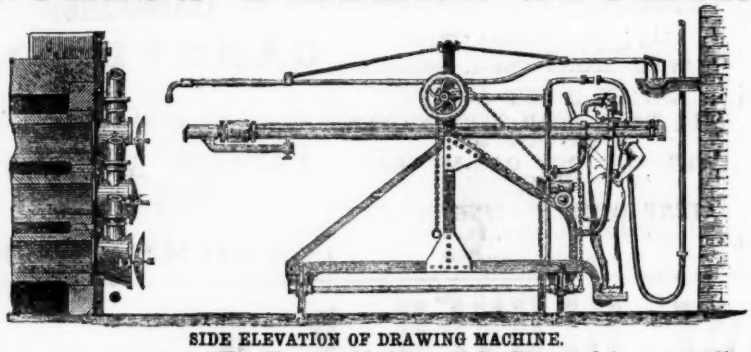
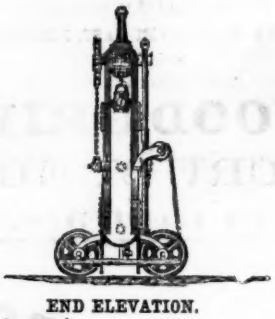


SIDE ELEVATION OF DRAWING MACHINE.



END ELEVATION.

(The Charging Machine will be Illustrated in next week's Advertisement.)

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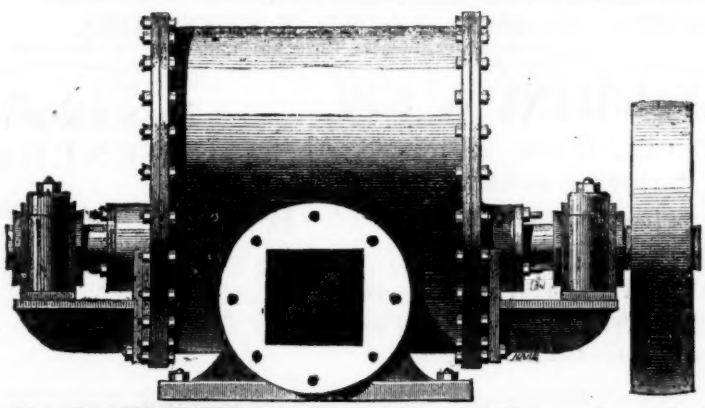
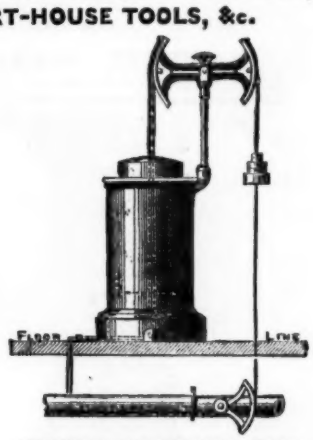
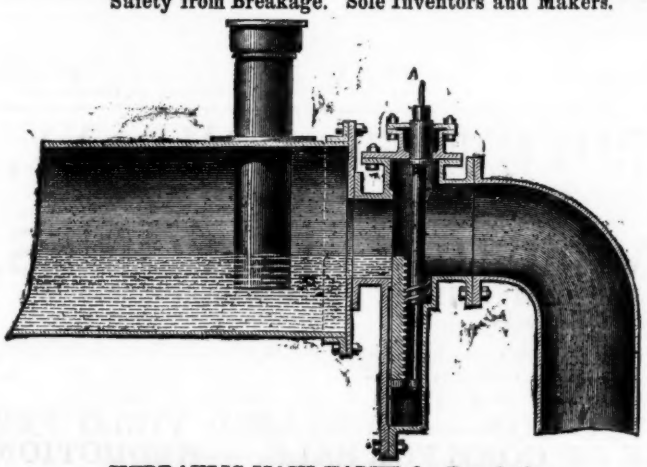


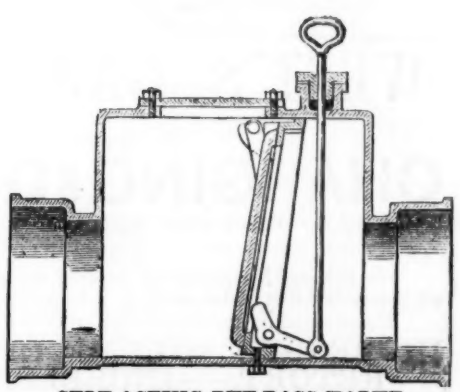
BEALE'S EXHAUSTER, with Wrought-Iron Spindle, ensuring perfect Safety from Breakage. Sole Inventors and Makers.



HYDRAULIC REGULATOR.



HYDRAULIC MAIN VALVE for Regulating Seal of Dip-Pipes.



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The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

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The Silber Tubulated Gas-Burner.

No. 291.

The Silber Tubulated Gas-Burner, with Opal Shade and Cup and Governor attached.

The *Lancet* says: "Mr. Silber has obtained a light of singular steadiness, whiteness, and illuminating power, with the great additional advantage of such perfect combustion as to preserve the purity of the atmosphere."

The manager of the gas-works at Southport says: "When our gas is 18 candles with the Standard burner, the Silber gives it as 22. You ought to get it noticed by the gas managers at once."

No. 286.

The Silber Bat's-wing Gas-Burner.

The Times says: "Besides the Argand burners, some improved Bat's-wing burners of different sizes were exhibited. In these there is an internal chamber permitting the expansion of the gas before it reaches the flame. They are constructed to burn from two to eight cubic feet of gas per hour, and the illumination they give ranges from 4 to 30 candles, a considerable improvement upon any burners of the same kind that have hitherto been constructed."

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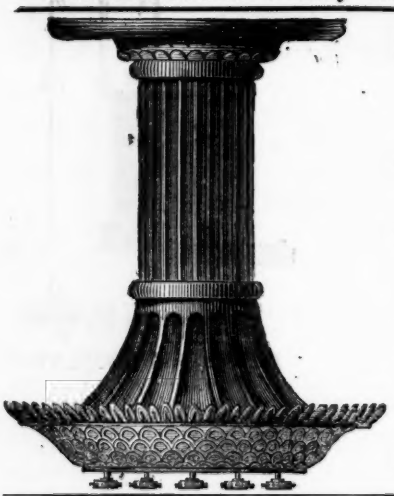

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SUN-BURNERS,

With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

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ARCHITECTS' OWN DESIGNS WORKED OUT.

ESTIMATES FREE OF CHARGE.

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SOLE CONSIGNEES FOR BRÖNNER'S IMPROVEMENTS IN GAS LIGHTING.

IN THE MATTER OF

BRÖNNER'S GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Consignees for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, inform the public that, on the 20th of April, 1875, Julius Brönner obtained an injunction in Chancery against a defendant prohibiting him from advertising or selling as Brönner's Burners any Gas-Burner not manufactured by Julius Brönner.

Also, he obtained a similar injunction against another defendant on the 9th of November, 1875.

Also, he obtained a similar injunction against another defendant on the 13th of January, 1876.

Also, he obtained a similar injunction against another defendant on the 16th of March, 1876.

Also, he obtained a similar injunction against another defendant on the 6th of April, 1876.

HENRY GREENE AND SON invite the attention of the trade and public to the above proceedings, which they will continue to maintain against any person infringing Mr. Brönner's rights.

WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

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LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

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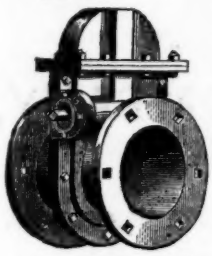
IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



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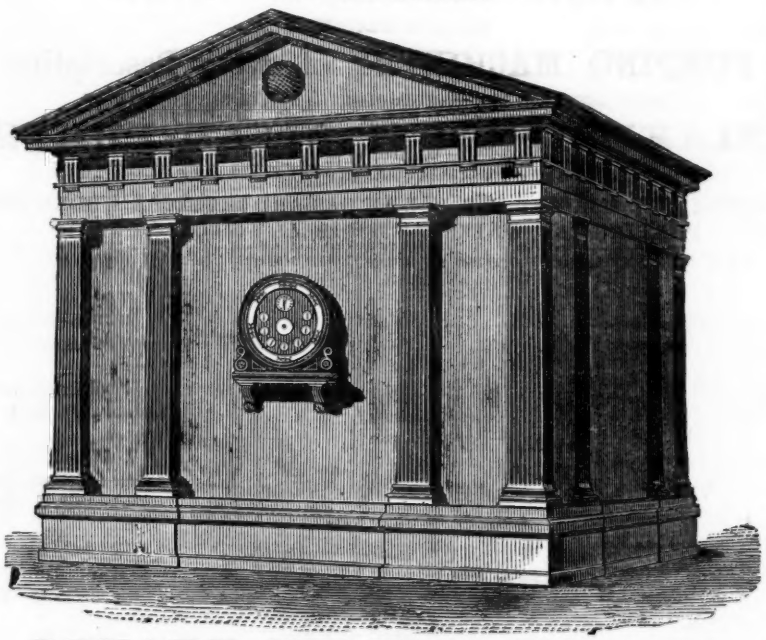

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Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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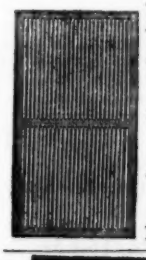

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No. 8, Self-Lubricating Packing, any size, 1s. 8d. per lb. This Packing supersedes all other kinds for High and Low Pressure Steam and Pumps. No. 7, 1s. per lb. No. 5, Self-Lubricating Double-Twisted Soft Laid Cotton Packing, 1s. 8d. per lb. No. 2, Cotton and Soapstone, 1s. per lb. No. 6, Canvas Rope, with India-rubber Core, 1s. 8d. per lb. Canvas made from all Long Flax. Any Quantity can be forwarded from 1 lb. upwards, and carriage paid on ¼ cwt. and upwards to any Railway Station in the Kingdom. Tarred and White Yarn for Pipe-Joints, Torch Yarn, Coke Sacks, Fall Ropes, Cotton Waste, &c., at various prices, according to quality.
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THE
SILICA FIRE-BRICK CO.,
OUGHTIBRIDGE,
Near SHEFFIELD,
Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces, and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

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BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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Of all Dimensions for Gas-Works,
GLASS-HOUSE POTS & CRUCIBLES
Of every kind.
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PREVENTS WASTE OF GAS FROM RETORTS;
SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;
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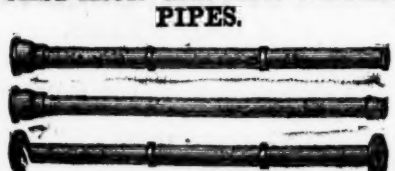

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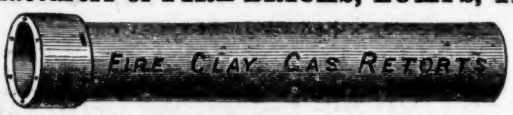

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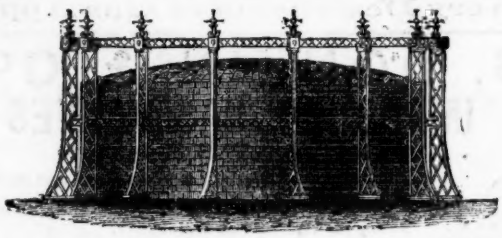
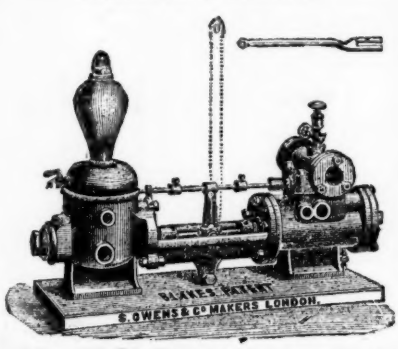


THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,
WHITEFRIARS STREET, LONDON, E.C.,
HYDRAULIC ENGINEERS,
AND MANUFACTURERS OF
PUMPING MACHINERY of every Description.
SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF
BLAKE'S PATENT STEAM-PUMPS,
More than 10,000 in use,
ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.
The following are some of the prominent advantages of the BLAKE PUMP:—

It will start at any point of stroke.
It has no dead point.
It works fast or slow, with the same certainty of action.
It is economical. Has a lead on the slide-valve.
It is compact and durable.



It is interchangeable in all its working parts.
It will deliver more water than any other pump.
It is made of best materials in the most workmanlike manner.
Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF
MANN & OWENS
IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

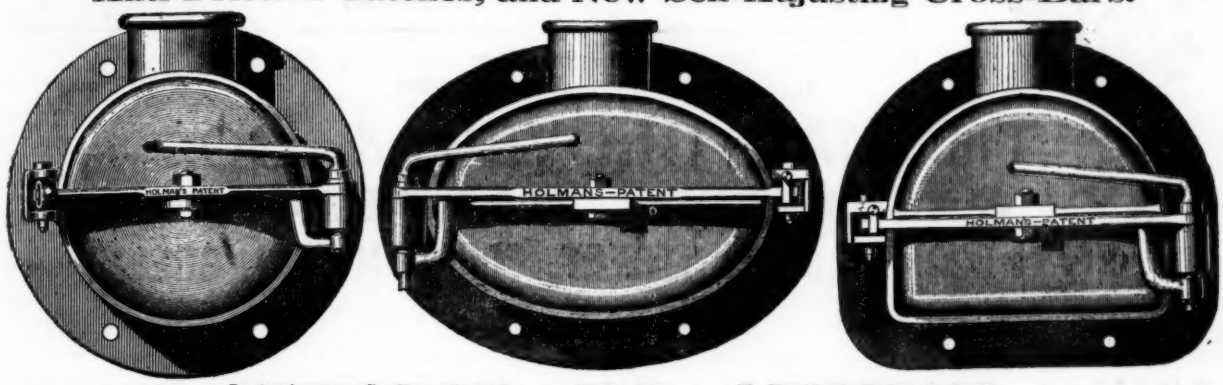
TANGYE BROTHERS AND HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), being now in use in nearly all the principal Gas-Works in London and the Provinces.

Messrs. T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT ITSELF (see Illustrations above), instead of, as heretofore, bringing the Mouthpiece from the D or Oval at back to Circular in front.

D and Oval Morton's Lids have now been working satisfactorily for the past two or three years, both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

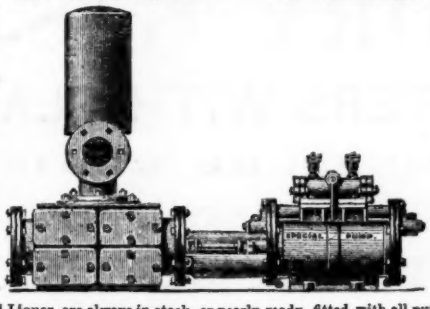
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851 New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

Erratum.—*In the report of the proceedings at the Worship Street Police Court, published in our last No. (page 678), by a typographical error, Mr. Addenbrooke, in his evidence, is made to say that his testings for purity extended over 24 hours, according to the Instructions of the Referees. It should have been 20 hours each day.*

Caution to Gas Managers.—*Mr. Bouttell, of the Sleaford Gas-Works, wishes us to caution gas companies against employing a man who recently obtained a situation with him, as gas-fitter, upon certificates for ability and integrity, which ultimately turned out to be forged. The man is about 35 years of age; height 5 feet 8 or 9 inches, thin, and wears a beard. He has been in service in Leominster, Gloucester, Cardiff, &c.*

The Annual Reports of Major Bolton and Mr. Stoneham on the Metropolitan Water Companies, which we promised last week, are again unavoidably postponed. The same remark applies to the reports received respecting the amalgamation of the Melbourne Gas Companies, the report of the Salford Corporation Gas Committee, &c., &c.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 6, 1877.

Circular to Gas Companies.

We are so often told that gas-testing in the Metropolis is no better than a farce and a sham, that the conviction of the Commercial Gas Company must be a matter of surprise to some people. It is true that, by neglecting to appeal, the Company lost their only chance of avoiding the penalty, and had nothing to do but to pay. Still, we have no right to assume that, if an appeal had been made to the Chief Gas Examiner, the result would have been different. The case then goes to show that gas-testing in the Metropolis is a reality, and not a sham. It may not appear always satisfactory, and it entails a heavy cost on the Companies, but we believe that, in the long run, both the Companies and the consumers are benefited. It is as regards illuminating power that we hear the greatest complaints. Men of eminence, thoroughly acquainted with the subject, and whose houses have the best fittings and arrangements, tell us that gas gets worse year by year. It may be that they grow older year by year, and that their sight gets dimmer, still their complaints can hardly be passed over. We hear them with much regret, but believe them to be entirely unfounded. The gas supplied to the Metropolis, at the present time, we consider to be fully equal, in illuminating power, to any hitherto distributed, and infinitely superior as regards purity. There is, in fact, nothing to be desired but that Gas Companies should obtain power to exercise some control over the fittings of consumers. The duty, we must confess, would be onerous, and, in many cases, unpleasant; but, in view of the satisfaction which would be obtained, future enactments should provide for the supervision we suggest.

We read in a contemporary, but we do not know on what authority, that the sulphur question is to be fought over again next session. In our opinion it will be very unwise to reopen the discussion of a matter on which public opinion is very pronounced, and professional bias may be said to be very evenly distributed. That sulphur can be taken out of gas must be accepted as a fact; what remains to be determined is the means by which this can be effected without creating a nuisance. The lime process, as at present employed, is effective, but costly. Alternative processes, conducted in closed vessels, and the revivification of lime, as proposed by Mr. Hislop, seem to offer a solution of the difficulty in respect to both nuisance and cost. Which method may ultimately be adopted with success can only be settled by careful experimentation. Alterations of plant, of course, cost money; but, when the public voice is so unanimous as it is on the sulphur question, a little expense must not be regarded, it being always understood that if the consumer requires pure gas he must pay for it.

At the recent municipal elections in Birmingham, considerable attention seems to have been given to the gas question, and the Gas Committee of the Corporation, it is reported, have made some modification of their present regulations. They have, it is said, decided, for the future, not to exact deposits, which, we think, is a mistake. If the Corporation are not to make a large number of bad debts, it will necessitate a rigorous collection, which may prove more annoying to small consumers than the exaction of a deposit, if the money bore a small rate of interest. The rights of consumers, as apart from ratepayers, to the profits of the Corporation undertaking, seem also to have been considered, and we are not without hope that the gas undertaking of the Corporation of Birmingham will be eventually managed on the co-operative principle we advocate.

The Birmingham arbitration case, after several days hearing, stands adjourned to the 27th of December next, when the cross-examination of the Town-Clerk and Mr. Hack will be proceeded with.

The Liverpool United Gas Company, desirous to ascertain their exact relations with the Town Council, have frankly, through their Solicitor, told the Gas Committee that the shareholders had no desire to part with their property, but that, if the Council resolve that the purchase of the Company is desirable in the interests of the town, they will carefully consider any proposals that may be made. In the meantime, in the absence of such formal resolution, they consider interviews with deputations of the Council premature.

We are happy to see that the Town Council of Salford have recognized the eminent services they have received from their present Gas Manager, by unanimously raising his salary from £500 to £700 per annum. The Salford undertaking, it is justly said, has "turned a corner," and if things continue to go well, it may be expected that the price of gas will gradually approach that charged on the other side of the river. The circumstances, however, of the Corporations of Salford and Manchester, with respect to their gas undertakings, are so different, that perfect equality of price can never be realized. We are certain, however, that nothing will be wanting on Mr. Hunter's part to bring down the price as low as possible. We have received the annual report of the Gas Committee just as we go to press, and must reserve our remarks thereon until next week.

We publish, at length, in other columns, the Gas Accounts of the Corporation of Manchester, from which it will be seen that the profit realized in the year ending the 24th of June last was £100,539, which is about £700 less than was obtained in the previous year. Out of the profits of the last year, the Town Council have carried no less than £42,133 to the Improvement-Fund, and after defraying all the charges on the undertaking they have over £6000, which they have carried to a reserve or contingent fund, which, under the circumstances, can hardly be required. The excess of assets over liabilities in the Manchester undertaking is so large, and the profits are so firmly guaranteed, that a reserve-fund cannot be considered as necessary. The consumption of gas naturally goes on increasing within the districts supplied by the Corporation of Manchester. In the past year, the number of consumers was added to at the rate of 3·48 per cent., and the consumption of gas increased 4·93 per cent., as compared with the previous year. The length of mains possessed by the Corporation is now above 545 miles, an increase of fourteen miles over the previous year. With regard to the quality of the gas, we have the somewhat vague report of Mr. Leigh. The illuminating power, taken on the average of the whole year, has been 19·3 standard candles. The purity, except with respect to carbonic acid, which averaged from one

to three per cent. on the year, is not stated. As regards sulphur we are told nothing, and we rather look to Mr. Leigh to give us some information on the subject. It is disappointing to be told that the amount of this ingredient, which is regarded as so obnoxious, "varied with the quality of the coal used."

While we congratulate the Corporation of Manchester on their success in the management of their gas undertaking, we cannot refrain from remarking once more that, notwithstanding the reductions of price which we have recently announced, the gas is far too dear within their limits. It is ridiculous to speak of the risks of the ratepayers of Manchester, when the assets so far exceed the liabilities of the undertaking; but, as the Corporation are incurring large additional liabilities, we shall say nothing further on the subject.

A very able paper by Mr. Stewart, of Greenock, on the construction of gas-works, elicited an interesting discussion at the meeting of the West of Scotland Association of Gas Managers, a report of which we continue to-day. As to the general plan of a gas-works there cannot be two opinions; and, as a matter of fact, Mr. Stewart's recommendations are exactly those of a model plan issued by the Board of Trade in 1870. With regard to internal arrangements, however, differences of opinion prevail; and having had, we confess, little experience in the manufacture of such gas as is supplied from Scottish works, we are not competent to express any decided opinion. The number of retorts to an oven, and the duration of a charge, must be settled by those who have experience in the employment of coals of the rather variable quality distilled in Scotland. The position of the hydraulic main is another matter. It ought to be so near to the retorts that the tar should be kept warm and in a thoroughly liquid state, and yet not so close that the tar may be distilled and leave a residue of pitch, a result which has been achieved by some eminent gas engineers. We need say nothing as to the views of Mr. Stewart on exhausters and scrubbing, &c., &c., except that they express the opinion of a skilled engineer engaged in large works, and therefore are entitled to all respect. It is gratifying to know that Mr. Hislop's process of revivifying lime is attracting attention. The fact that the revivification can be effected at 8s. 6d. per ton will be welcome news to many English Gas Companies.

The Town Council of Aberdeen have resolved on reducing the price of gas to private consumers one penny per thousand. This is not very much; but if the report is correct, they are, at the same time, determined to reduce the charge to public lamps one shilling per thousand, which will be a considerable relief to the Aberdonian ratepayers.

As winter approaches, our medical contemporaries, while professing to furnish scientific information for their class readers, deal in the horrible to frighten the general public, and at this season of the year indulge in illusions of the supposed pernicious influence of the products of the combustion of gas. The use of gas, it is said, in these veracious prints, involves a process of slow poisoning, which no art can at present obviate. Ventilation, we are assured, is useless. All that we can say is that the process of poisoning is an extremely slow one. We look round a well-lighted drawing-room in vain for any indication of "depressed vitality." When Papa dozes and Mamma darns, young ladies, no doubt, feel dull and depressed, while their brothers come home from a stifling billiard-room in the most vigorous condition. We have nothing to say against our medical contemporaries, whose intentions may be good enough, but we do wish they would be reasonable and not exaggerate.

When Cleopatra's Needle is carried from the banks of the Thames to its eventual resting-place, either in front of St. Paul's or Westminster Abbey, we fear there may be some crushing of gas and water pipes. Under these circumstances, it is satisfactory to find that a Metropolitan Police Magistrate has decided that traction-engines and steam-rollers are not to be considered ordinary traffic, and if damage result from extraordinary traffic, those who occasion it must bear the loss. The patriotic donor of the Needle—for it is rather Mr. Erasmus Wilson than Mehemet Ali who gives it to the English nation—is very experienced in gas matters, and we have no doubt every precaution will be taken, so to distribute the weight of the monolith as that no accident may happen comparable to that which befell the steam-roller in Smith Street, Chelsea, and formed the subject of proceedings at the Westminster Police Court last week.

The Corporation of Gateshead have indulged in a steam-roller, the utility of which for smoothing roads we fully recognize. It is, however, a novelty which has caused much injury to gas and water mains, and the Gas and Water Companies at Gateshead remonstrate against its use, and very properly hold the Corporation responsible for any damage that may be caused to their mains. We have said that we recognize the utility of steam-rollers for smoothing roads; but, with all our sympathy for horses, who are, by their use, relieved of much labour, we doubt the economy of employing them. They crush stones to powder, and the consequence is an enormous production of mud when rain occurs. Stones rolled in by the ordinary traffic get, so to say, dovetailed and impacted together, so that a firmer and more lasting causeway is produced than when the metal is crushed by the steam-roller. It is suggested that Gas and Water Companies should lay their mains at a lower depth. This will, no doubt, be done in the future; but, in the meantime, Local Authorities must be held answerable for any damage occasioned when they indulge in steam-rollers.

The address of Mr. Warner, delivered at the meeting of the North of England Gas Managers Association, will be read with much interest for the historical particulars which it supplies. The early decease of the Gas-Fitters Mutual Association was greatly to be deplored, for the objects it was founded to accomplish were of an eminently practical character. We shall not say that the British Association of Gas Managers does not fulfil, to a great extent, the purpose of the defunct Association; but we may remark that, up, at all events, till recent years, more attention was given to details of manufacture than to the relations of Gas Companies with the general public, which the Associated Gas-Fitters first considered. We may express a hope that, in future years, with the able advice of Mr. Warner, means will be provided for instructing the general public in the use of gas, and the best means of employing it. Associations such as that now alluded to, may do much to diffuse information of a less technical character than that which generally attracts their attention. We wish to see gas in every house, and, indeed, in every room; and for that reason desire to see more consideration given to the matter of fittings and appliances.

From a letter by M. Brémond, which we publish in another column, we may gather that he has practically abandoned his theory of the production of naphthaline in mains and pipes. As to the advantage of desiccating gas, so that it may be able to retain, in vapour, the naphthaline produced in the retorts, we are quite at one with the writer, for reasons we have before stated.

That great improvements in the production of gas from coal are possible, no one will for a moment dispute. It may be admitted, without qualification, that a larger amount of gas may be obtained from coal than what is yielded by the ordinary process. It has, more than once, been suggested in these columns that gas might, and probably will some day, be produced without tar, which, from one point of view, may be regarded as waste. How far Mr. Symes has succeeded in accomplishing this object, it is impossible to say, after witnessing a very crude experiment on Saturday last. His apparatus, as exhibited, consisted of a vertical retort with an inclined eduction-pipe, down which the tar flowed back to the retort, and was supposed to be converted into permanent gas. This gas passed on to a washer, which was said to deprive it of ammonia, and subsequently to a lime purifier, where carbonic acid and sulphur were expected to be caught. We have a fear that more is claimed for the process than is likely to be realized in actual practice on a large scale. It is asserted that over thirteen thousand feet of gas can, by this system, be obtained from ordinary coal, and that the gas will not contain more than three grains of sulphur per hundred feet, and be absolutely free from ammonia and sulphuretted hydrogen. We must take these statements for what they are worth, for no demonstration of the truth of them was attempted on Saturday; but we may say that the gas made on the occasion was of fair illuminating power, and, so far as we had the means of observing, was of ordinary purity. It is, however, a great pity that inventors will make experiments with incomplete appliances. No one would rejoice more than ourselves over improvements in the art of gas-making, and we are only sorry that we cannot say more in praise of the process employed by the Pure Carbon Gas Company. It has, we are told, received the approval of some practical gas makers in the Metropolis, and we shall watch its future with some interest. We may mention, that when the vertical retort, such as we saw, is employed, means are provided for the removal of the coke at the bottom. In connection with the process a carburettor was exhibited, about which, perhaps, the less said the better.

We publish in another column a very able paper on the relative cost of lighting by means of electricity and gas. The writer, who does not seem to be concerned for any Gas Company, clearly shows that if a large amount of light be required, which could only be utilized in lighthouses, the electric light may be economical; but when an amount of light is wanted just sufficient to illuminate to the extent of the space required to be lighted, gas is undoubtedly cheaper. It is, in fact, the great merit of gas lighting that it can be employed when, and where, and exactly to the extent, it is required, and in this respect no other illuminating agent can compare with it.

Water and Sanitary Notes.

THE rapidly increasing indebtedness of Local Authorities, as revealed in the Sixth Annual Report of the Local Government Board, an abstract of which we published in our last issue, cannot fail to attract the attention of economists. For ourselves, we must confess that we view, with some alarm, the rapid accumulation of loans by Local Authorities. It appears that, in the course of the last three years, the sum sanctioned made up more than a third of the total amounts for the last twenty-nine years. Loans necessitate rates, and at the present time the ratepaying power of the community is greatly diminished. The profits of trade are low, and the general income of the country is reduced. So far as borrowed money is devoted to productive purposes, there is, of course, nothing to be said against the debt being incurred. It is urged, however, that all sanitary work is productive. It saves doctors and undertakers bills, and keeps a number of people off the books of the Poor Law Guardians. However this may be, rates go on continually increasing, and there is a general expression of dissatisfaction all over the country.

In the report, we notice how tight a rein our grandmotherly Government keeps over Local Authorities. They can do nothing without the consent of the Central Authority, who, besides sanctioning the loan, carefully watch to see that the debt is paid off. Perhaps this is a wise and necessary step, although it a little reflects on the integrity of our vaunted system of local self-government, inasmuch as it intimates that Local Authorities cannot be trusted to pay their debts.

The Rivers Pollution Act is another illustration of this interference of the Central Authority with the local governing bodies. That Act can be either set in force or kept in abeyance, in opposition to the will of the Local Authorities. There may be good reasons for this. First of all, manufacturers who create offences find places on Local Boards, and might decline to prosecute themselves; and then there are always people in such bodies inclined to indulge in personal spite. Perhaps, then, after all, the action of the Central Board may be beneficial. In any case, the public will regard with satisfaction the appointment of the two Inspectors under the Act—Mr. R. Rawlinson, C.B., and Dr. Angus Smith, F.R.S.

A good deal of nonsense continues to be written about the Thirlmere scheme of the Manchester Corporation, but, on the the whole, it may be said that common-sense views of the subject begin to prevail. It seems to be acknowledged that, while the area of Thirlmere Lake would be greatly extended, its natural beauties will be rather enhanced than defaced. The strip of water now nearly cut in two by projecting tongues of land, will be made one wide expanse, diversified by two picturesque islands. The absurd idea that wide strips of offensive muddy banks would be exposed if the water were low in the summer months is shown to be a delusion, the character of the water and the nature of the soil both precluding the possibility of such nuisance and deformity. Further than this, it is certain that, unless in the case of an exceptionally long drought, the shore of the lake, which we hope will be formed, will never be at all exposed —certainly never while the demand on the lake is confined to the ten million gallons a day to which it is proposed to limit it. We see, with satisfaction, that the overtures of the Corporation of Manchester to the few residents of the district are cordially received, and it is acknowledged that the works the Corporation propose to make will tend to the general improvement of the country in an utilitarian sense. Manchester, we may say, is unanimous as to the scheme, and the appeal of the Bishop of Carlisle, to the inhabitants of the city who occasionally visit the Lake district, has met with no response. Manchester wants water, and even if there were reasons, which certainly do not exist, for thinking that the natural beauty of Thirlmere would be destroyed, it would not in the least prevent the Corporation pushing on their scheme. Wigan and Oldham, we notice, desire to share in the advantages of a large supply of pure water, and they are certain to be met by the Corporation of Manchester in a very liberal spirit. Other towns on the route of the aqueduct are likely to desire to participate, and by the time the works for the first instalment of ten millions per day are completed, we think it probable it will be found necessary to double their capacity.

The Arbitrators and Umpire selected to assess the sum to be paid by the Corporations of Stockton and Middlesbrough as compensation for the prospective value of the undertaking of the Stockton and Middlesbrough Water Company, met on the 30th ult., but, in consequence of the elevation of the Hon. A. E. Thesiger to the Bench, the proceedings were adjourned until the 14th of January next. Thus the transfer of the undertaking to the Corporations cannot possibly take place till July 1, 1878.

Leicester hesitates to spend £300,000 on the sewerage of their district, and the proposed method of utilizing the sewage. We do not blame the Town Council. Local circumstances render their case a peculiarly difficult one, and the year they ask for the fuller consideration of the schemes that have been submitted to them must be considered a reasonable concession. Leicester has been the scene of many sewerage experiments, which promised to bring considerable gain to the town—promises which were never realized. The utmost that can be done is to get rid of the sewage at the least possible cost. Profit by utilization is not at present to be expected; but in the course of the next twelve months the Town Council of Leicester may be enabled to decide on a scheme which shall cause the least possible drain on the rates of their district.

WATER LEGISLATION IN 1877.

THE following Water Acts were passed during the last session:—

The *Carnforth District Water Act* incorporates the Carnforth District Water Company. The capital of the Company is to be £15,000, carrying borrowing powers to the usual extent of one-fourth of that amount. The water is to be obtained by an impounding scheme. No rates are given by this Act. For the rest, the Company obtain all the powers usually conferred upon a Water Company.

The *East Worcestershire Water Act* incorporates the East Worcestershire Water Company with statutory powers to supply with water the borough of Droitwich and the towns of Bromsgrove and Redditch. The capital of the Company is to be £80,000, in £10 shares, carrying, of course, the usual borrowing powers. The source of the water is to be a well in the parish of Bromsgrove. Water is to be supplied at a rate not to exceed six per cent. on an annual rack-rent or gross rateable value; if supplied by meter, the charge is to be from 1s. 6d. to 1s. per thousand gallons.

The *Falmouth Water Act* confers further powers upon the Falmouth Water-Works Company. The capital of the Company consists of £20,000, all of which has been raised, and the usual amount borrowed. This Act gives power to raise additional capital to the amount of £15,000, in £10 shares. The usual borrowing powers are granted. The dividend on the new capital is limited to seven or six per cent., according as it is raised.

The *Heywood Water-Works Act* is to confer additional power on the Heywood Water-Works Company. Up to the passing of this Act, they have raised on original share capital the sum of £76,468, and have borrowed £23,983. The present authorized capital of the Company being £100,000, and the borrowing power £28,000, no power to raise additional capital is granted, and the Act is simply to authorize them to acquire additional lands, and to construct additional works.

The *Kent Water-Works Act* extends the limits of the Kent Water-Works Company, authorizing the construction of additional works, and enables the Company to raise further capital. The present capital of the Company is £600,000. By this Act the Company get power to raise additional capital to the extent of £160,000, carrying borrowing power to the usual extent. The rate of dividend is six or seven per cent., according as it is raised. This Act extends the limits of the Company over a considerable area in the county of Kent. The additional works authorized comprise a well, or wells, and pumping-station in the parish of Beckenham, and a reservoir in the parish of Farnborough, with the necessary means of distribution within the extended limits.

The *Lowestoft Water, Gas, and Market Act* authorises the Company, *inter alia*, to construct additional new service reservoirs, and for that purpose to acquire additional lands. The additional capital authorized was mentioned in the Act concerning gas.

The *Newcastle and Gateshead Water Act* is to empower the Newcastle and Gateshead Water Company to abandon certain works authorized by their Act of 1876, and to construct others in lieu of them. No further capital is asked for.

The *North Cheshire Water Act* confers further powers on the North Cheshire Water Company. The present capital of the Company, all of which has been raised and expended, is £36,000, and they have borrowed to the full extent. By this Act the Company are empowered to raise additional capital to the extent of £36,000, and to borrow to the usual amount.

The *Stamford Water Act* authorizes the Marquis of Exeter to give a constant supply of water to the town and borough of Stamford, and empowers him to make and enforce all such regulations as may be necessary for the prevention of waste and the misuse of water. In case any dispute as to the regulations arises between the noble proprietor and the Urban Sanitary Authority, the Local Government Board may appoint a competent engineer to settle the differences. While enjoying all the privi-

leges of a Water Company, the noble proprietor is naturally subjected to their obligations.

The *Sunningdale Water Act* incorporates the Sunningdale District Water Company, with power to supply several parishes in the counties of Berks, Middlesex, and Surrey. The capital of the Company is to be £100,000 in £10 shares, with borrowing power to the usual extent. The source of the water is to be a well in the parish of Windlesham, in Surrey, with a reservoir at Chobham. The rate which may be charged is seven and a half per cent. per annum on the gross annual rent, with the usual charges for baths, and for extra water-closets. Water for other than purely domestic purposes is to be charged for by agreement.

The *West Surrey Water Act* authorizes the West Surrey Water Company to raise additional capital. The present capital of the Company is £25,000, nearly all of which has been raised and expended, and they have borrowed money to the extent of £6000. Additional capital may be raised to the extent of £25,000, the limits of dividends as usual. Borrowing power to the usual extent is granted.

In all the above Acts, the now customary clauses for the protection of telegraph wires are inserted, and the newly-formed Companies obtain all the powers and privileges usually granted to Water Companies.

Gas-Meter Company.—We are gratified to learn that at the last general meeting of the Gas-Meter Company a testimonial was voted by the shareholders, with great unanimity, to the chairman of the company, Mr. C. Nicholson, in recognition of his valuable services, and we understand it is to take the form of a marble bust portrait.

Quality of the Newcastle-on-Tyne Gas.—The following are the results of Mr. John Pattinson's examination for the past month of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
Oct. 2	15·5	7·02	Nil.
„ 5	15·2	7·94	„
„ 9	14·8	17·33	„
„ 12	14·8	12·34	„
„ 16	15·5	10·92	„
„ 19	14·6	9·18	„
„ 23	15·0	6·73	„
„ 26	15·2	6·93	„
„ 30	14·8	6·84	„

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament, the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

Recovering Gas-Rents.—At the Clerkenwell Police Court, on Thursday last, Samuel J. Flight, of 47, Union Street, Borough, was summoned by the London Gas Company for £3 17s., due for gas supplied to premises at 77, Red Lion Street, and was committed to Holloway Prison for 21 days, in default of payment or goods on which to levy for the debt.—At the Wigan Borough Police Court, on the 29th ult., seventeen summonses were returnable for non-payment of gas bills. Two of the cases were settled before being called, thirteen were adjourned, in one an order to pay in a month was made, and in the last, Mr. Thomas Johnson, the defendant, stated that when the first account was delivered he tendered the amount of the bill to the officer of the corporation, but he refused to take it. He had subsequently been to the gas-works and offered to pay the bill less the usual discount, but as the officials refused to accept the money less the discount, the bill was still unpaid. He was quite willing to pay the money, but as he had tendered payment four times he contended that he was entitled to the discount. Mr. Ralph Bolton, who appeared for the Corporation Gas Committee, said the account was delivered by one of the meter inspectors. These officers were not allowed to receive money for gas accounts, and defendant was told so at the time. The mayor said the magistrates would not make an order in the case, but would recommend the defendant to pay the money, and the corporation officials to allow the discount. The defendant said he was quite willing to pay the money, but he should decline to take it to the gas-works; the Gas Committee must send for it. He applied for expenses, but the Bench declined to allow them.

Bristol Gas Supply.—At the meeting of the Bristol Town Council on the 30th ult., the gas examiner (Mr. B. Kitt) presented the following report:—"I have the honour to present my quarterly report on the public gas supply of your city, its illuminating power, chemical quality, pressure, and the number of the public lamps in the city and county; also the number of gas-meters examined and tested under the Sales of Gas Act and found correct, and the number of those found incorrect. The average illuminating power of the gas during the past quarter has been equal to 15·10 sperm candles, burning at the rate of 120 grains of sperm per hour; this result shows that the quality of the gas has been 1·60 candles above the parliamentary requirements. The highest intensity of the light was equal to 15·50 sperm candles, and the lowest 14·78 candles. With respect to the chemical quality, I have examined for but not detected the presence of sulphuretted hydrogen. I have observed traces of ammonia on several occasions, but the amount obtained from a quantitative analysis has not been beyond the limits allowed by the Act of Parliament. The specific gravity of the gas has ranged between 547 and 552, the average being 549. As regards the pressure at which the gas has been supplied to the public, it has on two or three occasions been barely equal to the standard. It is important that the full amount should be given, or otherwise the public lamps do not give the stipulated quantity per hour per burner; the highest pressure was 1·8 inch, and the lowest 5-10ths of an inch. The number of the public lamps to the 29th of Septemper last amounted to 4032, and are situate as follows—1488 City, 714 Clifton, 698 St. Philip's, 478 Bedminster, 352 District, and 302 Westbury. Two new lamps have been erected during the quarter, and have been placed as follows:—one in Bedminster, and one in Westbury. The number of gas-meters examined and tested under the Sales of Gas Act has been 148, of which 83 were stamped as correct, and 65 denounced as incorrect. The total number tested since the commencement of the Gas Act to the 29th of September last amounted to 11,068."

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

ILLUSIONS.

Sir,—Men like to be tickled by novelties. They are fond of the mysterious, and if the advocates of the mystery can manage to surround it by a few broad assertions—all the better if they are somewhat difficult of proof—they get distracted from the mystery itself, and fix on the assertions; and, if they promise benefit, the wish to reap it leads to the swallowing of the mystery, assertions and all.

A good mechanical stoker is a thing much to be desired. We have had several, the advocates of which are not content with showing us, or telling us, how well they perform their work, but they assert, in addition, that the yield of gas per ton is augmented by their use, the quality of the coke improved and, as mysterious as all, the illuminating power of the gas increased.

Now, I suppose these additional advantages must be believed in by their advocates, or they would not be publicly stated as they are. Still, I must confess that, while I am anxious to see perfected any mode of working retorts that will relieve men of such laborious and dirty work, I have never seen any machine that did the work better than the ordinary scoop. I have seen it done both cheaper and quicker by machinery, but all the additional alleged advantages I believe to exist more in the brain than in the working results.

Another instance is the many advantages that accompany the use of a steam-jet exhauster. This apparatus also is supposed to increase the illuminating power of the gas, and theorists are discovering that the steam may keep among the gas some of the light-giving elements which, without it, would get condensed amongst the tar. Suppose there is something in this—that the gas may be made richer and the tar poorer, I suppose the same benefit would be obtained if, for instance, the exhaust steam from the exhauster-engine were puffed into the gas-pipe instead of into the atmosphere.

A couple of years ago, when the steam-jet exhauster was talked of, being desirous of knowing something of it, I put some practical questions to one of its advocates, but I failed in obtaining the information I sought. I had two gas-works which I had hitherto thought too small to provide exhausters for; but finding, year after year, that they yielded me 1000 feet less gas per ton of coal than other works where I had exhausters in use, although supplied with the same kind of coal, I determined to solve my queries myself, and fixed a steam-jet exhauster between the hydraulic main and the condenser. The result was perfectly satisfactory; the pressure (about 7 inches only) was reduced, and steadily, and the yield of gas per ton was increased as at my other works; and that is all I can say in its favour.

The objections I found were—it took 60 gallons of water to produce steam for every ton of coal carbonized, and this, being added to the 10 gallons of liquor produced by the coal, rendered the whole so weak as to be worthless. Other means were required to feed the steam-boiler, which, if I had had an engine-worked exhauster, would have been done by it. My condenser was warmed throughout fully half its length, and had this not been more powerful than was necessary, I must have added to my condenser. Several of the pipes of the condenser got clogged with thick tar, which had to be frequently cleaned out. My experience, therefore, is dead against the steam-jet exhauster. In fact, I found not one single advantage, but several disadvantages.

If I had had an engine I would have done the work with one-half the fuel; it would have pumped its own water to feed the boiler, and, if necessary, it would have pumped water for the use of the works, and 50 per cent. of my condenser would not have been rendered useless for gas condensation, nor would my pipes have got stopped up by clotted tar.

Now, there is nothing wonderful in those results. They are, one and all, what any one who is acquainted with, and reasons on, the matter will expect. They are what I did expect. I have not been taken in. They are the price I have paid to enable me to speak from experience. The results may be a little worse than I expected, but this is only a matter of degree, and if any gentleman is desirous of becoming equally learned with myself, he shall have the exhauster at half price, when he will be in a position to coincide with or contradict my statements.

I do not intend to lose, however, by the experience gained, for, seeing that I can obtain 12 per cent. more gas by the use of an exhauster at even small works, I set about constructing a much smaller engine and exhauster than I had previously done, but on the same principle as my larger ones. The whole thing lies compactly on top of a small vertical boiler, about 4 feet high, and will exhaust 3000 feet of gas per hour, against 12 inches of pressure. It is fitted at my other works, where I would have put up a second steam-jet exhauster but for the reasons I have stated. So that out of a little evil I hope to develop a great deal of good.

George Anderson.

35A, *Great George Street, Westminster, Oct.* 29, 1877.

NAPHTHALINE.

Sir,—I have read in the number of your Journal for the 23rd of October a very interesting letter from Mr. Young, who, like yourself, contests that part of my paper, which you were good enough to publish, wherein I infer that the condensation of the aqueous vapour in the gas has an influence upon the production of naphthaline. Like yourself and Mr. Young, and, in fact, everybody else, I allow that naphthaline is due principally to reactions that take place in the retort. With regard to my particular hypothesis, my last experiments, as I have already informed you, having been made after the first part of my paper had been sent in in competition, I could not suppress it, and faithfully printed the two parts of the paper, with the experiments (sometimes contradictory) therein related, whatever criticism I might myself have to make of the theory—a criticism which ought inevitably to be made.

I gather, then, from Mr. Young's letter this fact, which very clearly confirms and guarantees the efficiency of my process (in the case of gas-works where the manufacture is conducted in the ordinary way) for getting rid of naphthaline, which is the cause of so much trouble—

namely, that when Messrs. Aitken and Young wished to saturate gases with the vapours of hydrocarbons produced from tars or oils heated to 90° Fahr., they were obliged, after the gases had passed the purifiers, and before their saturation—called "carburation" in France—had taken place, to dry the gases they desired to enrich with essential vapours, and that in order to prevent the re-absorption of aqueous vapour, in their special manufacture, they proposed to put paraffin oil into the apparatus traversed by the gases prepared by their processes. This necessity for removing the aqueous vapour in gases into which it is desired to introduce hydrocarbon vapours, in order that these vapours may remain in solution (which is the case in Messrs. Aitken and Young's process), demonstrates the efficacy of the process I propose for suppressing or preventing, by the desiccation of illuminating gas, the deposition of the naphthaline naturally to be found therein, whatever the cause of its production may be. These gentlemen and I, therefore, agree upon this matter of the desiccation of gases—Messrs. Aitken and Young for the purpose of introducing vapours into them, and I for ridding coal gas of the inconvenience of naphthaline.

Allow me, Sir, through the medium of your estimable JOURNAL, to thank Mr. Young for having thrown some new light upon the causes of the results I obtained in my experiments. From all communications made upon the subject of naphthaline, highly important advantages will result, and I shall be very pleased to have contributed to them. My thanks are also due to you for the space you have so kindly afforded me in your JOURNAL.

Versailles, Oct. 27, 1877. L. BRÉMOND.

SIR,—As I have observed some remarks in your columns which would lead those unacquainted with the details of M. Brémond's process for preventing the deposit of naphthaline to suppose that he had not contemplated the addition of oil to the various vessels ordinarily sealed with water, I beg to say that he was quite alive to the desirability of taking such precaution, and, therefore, distinctly described, in his specification, the manner, and to what apparatus this addition of oil should be applied. W. H. BENNETT.

22, *Great George Street, Westminster, Nov.* 3, 1877.

THE ELECTRIC LIGHT.

SIR,—The promoters of the electric light threaten gas undertakings with ruin. This may not be very alarming, especially if, as I believe, the tables may be turned. At present, the carbon points, or strips, produced from the "graphite" withdrawn from gas-retorts, seem to form an essential element of the electric light. Do the Turks supply arms to the Russians, or the Russians to the Turks? *Verbum sat sapienti.* This graphite may be used as fuel, under the retorts, and all gas managers should be instructed so to dispose of it.

A LARGE HOLDER OF GAS SHARES.

SALES OF GAS ACTS.

SIR,—Following the example of Mr. William Cowan in your last issue, I beg to offer a suggestion with reference to the proposed revision of the Sales of Gas Act, 1859—namely, that no meter should be allowed to be stamped which can be made to register inaccurately at variable speeds and pressures, or beyond a certain reasonable limit of error.

The liability of meters to register against the sellers of gas, when worked beyond their nominal capacity, is a source of greater loss to gas companies than is generally supposed, and deserves their serious consideration. It should be recollected that a gas-meter, unlike other measures in general use, is a flexible machine, subject to be called upon to perform, notwithstanding the most rigid inspection, a very varying amount of work.

I can hardly suppose that a Royal Commission composed of practical men, and having no interests of their own to serve, will be found to ignore this point.

Birmingham, Nov. 3, 1877. JAMES C. BENT.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.—At the meeting of the Board on Friday last, Sir W. Codrington, pursuant to notice, moved—"That it be an instruction to the Works and General Purposes Committee to report to the Board its proceedings on Water Supply to the Metropolis." He said there had been two questions referred to the committee—viz., the purchase of the existing water companies and the scheme prepared by Sir J. Bazalgette and Messrs. Bramwell and Easton. The Board ought to be informed of the steps taken by the committee before they were committed to any definite plan of action. Mr. Richardson said the committee were instructed by the Board "to prepare a Bill empowering the Board to take under their control the water supply of the Metropolis, with power to purchase the existing companies and extend existing works." They had also had referred to them the scheme of Messrs. Bazalgette, Bramwell, and Easton, and they would, when they were prepared to do so, report thereon to the Board. Mr. Rogers said the Board had never considered the latter scheme at all, and were not committed to it. The Bill which the committee were directed to prepare had reference only to the purchase of the existing works. Mr. Cooke thought it was inconvenient the scheme proposed by the engineers named should have been discussed at the British Association meeting while it actually had not yet been discussed by the Board. Sir W. Codrington, in reply, said he did not see why the committee should not make an *interim* report. The Board were ignorant of what the Works Committee were doing, and certainly their action was committing the Board in the eyes of the public, not, perhaps, in matters of detail, but in principle. The motion was then carried by eleven votes to three, and the committee were directed to report forthwith.

GLASGOW WATER SUPPLY.—Dr. Mills, of the Andersonian College, Glasgow, in his report on the water supply of that city during October, says that the ordinary pale brown colour of the water was nearly absent. Although muddy particles and fibres were still observable, the sample analyzed exhibited in this respect a great improvement upon the previous month. The results in parts per 100,000 were—Total solid impurity, 3·00; organic carbon, 0·196; organic nitrogen, 0·004; ammonia, 0·001; nitric nitrogen, 0·005; total combined nitrogen, 0·010; chlorine, 0·63; hardness, 0·63.

MANCHESTER CORPORATION GAS-WORKS.

REPORT OF THE GAS COMMITTEE FOR THE YEAR ENDING JUNE 24, 1877.

The Gas Committee present the following report:—

Your committee submit an abstract of the accounts of the gas department for the year ending June 24, 1877, and also the usual tabular and explanatory statements.

Appendix A shows the amount of lamp and private rentals derived from the townships within and beyond the city respectively for the past two years.

Appendix B, the quantity of gas transmitted from the works in the day-time, and during the whole 24 hours of the day, in each month for the same period.

Appendix C, the number of meters in use on June 24, 1876 and 1877, respectively.

Appendix D, the length and sizes of main-pipes laid and taken up during the year, and also the total now in use.

Appendix E, the amount of profit and the mode of its appropriation; the amount of borrowed money owing, and the excess of assets, &c., in each year from 1862 to the 24th of June last.

The rental for the past year (including meter-rents) has amounted to the sum of £333,740 19s. 8d., being a decrease of £589 3s. 7d.

The profit is £100,539 16s. 7d., as against £101,232 4s. 6d. in the previous year, and is appropriated as follows:—Interest on loans, £15,518 2s. 1d.; set aside and transferred to capital account towards liquidation of the mortgage debt, £27,729 15s. 8d.; portion of surplus payable to the improvement department, £42,133 16s. 3d.; repayment of balance of advances made to the improvement department, in anticipation of profits, in accordance with the arrangement sanctioned by the council on March 4, 1868, £8891 15s. 10d., leaving a balance of £6266 6s. 9d., which your committee propose to carry to a reserve-fund, which they think it desirable to establish to meet future contingencies.

The number of consumers has increased 3·48 per cent., amounting now to 71,678, as against 69,263 the previous year.

The quantity of gas supplied has amounted to 2,070,115,300 cubic feet, being an increase of 97,419,300, or 4·93 per cent. over the previous year.

Your committee submit the report of Mr. John Leigh, the consulting and analytical chemist to this department, with regard to the purity and illuminating power of the gas during the past year; and also the report of Messrs. S. E. Cottam and Son, the auditors appointed by the council, in reference to the accounts of this department.

"*Manchester, Oct.* 1, 1877.

"To the Chairman of the Gas Committee.

"Sir,—I have the honour to report to you that the average illuminating power of the Manchester gas during the past year has been equal to that of 19·3 London standard candles.

"The gas has been tested photometrically at the Gaythorn and at the Rochdale Road stations almost daily. The standard of comparison adopted has been the light of a London standard sperm candle burning at the rate of 120 grains per hour.

"The gas has been tested daily for sulphuretted hydrogen and for ammonia. It has also been allowed to flow continuously through test solutions, and the amount of impurity in large volumes of the gas has been determined. As the gas has passed through these solutions during the night as well as the day, and during Sundays as well as on ordinary days, any negligence in the purification at these times would have been detected.

"To the daily tests the gas has very rarely yielded any traces of sulphuretted hydrogen. From the large volume of gas flowing through the test solution (from 300 to 500 cubic feet per month) rarely has any of this impurity been separated, and in no case more than a small fraction of a grain.

"The quantity of ammonia in the gas manufactured at Rochdale Road station has, since the new condenser has been in operation, been only nominal; it has, in fact, rarely been in weighable quantity.

"The gas at Gaythorn station has been very carefully purified from this ingredient, and, although the new condenser has scarcely yet come into operation, has been very fairly free from it.

"From 1 to 3 per cent. of carbonic acid has been contained in the gas at Gaythorn station.

"At Rochdale Road, where the new condenser has been for a considerable time at work, the carbonic acid in the purified gas has been much less. The quantity of sulphur existing in the gas in combination with carbon, as bisulphide of carbon and organic sulphur, has varied with the quality of the coal employed in the manufacture of the gas.

"Now that both stations are furnished with suitable condensers, processes for the reduction of the amount of bisulphide of carbon may be brought into operation. "JOHN LEIGH, M.R.C.S. of England."

"*Manchester, Oct.* 22, 1877.

"The Gas Committee, Manchester Corporation.

"Gentlemen,—We have pleasure in reporting that we have completed the audit of the gas accounts for the year ending June last, and have certified to their correctness by affixing our signature to the various abstracts of the accounts in your books.—SAMUEL E. COTTAM AND SON."

The expenditure on capital account during the past year has amounted to the sum of £60,302 5s. 7d., the particulars of which are given in the summary of receipts and expenditure, and in the statement of assets and liabilities.

Your committee have had under consideration the question whether it is desirable to make any, and, if so, what alteration in the prices charged for gas, and have resolved to recommend the council to authorize the following reductions, to take effect from Dec. 25 next, viz.:—

Within the city, from 3s. 4d. to 3s. per 1000 cubic feet.

Outside the city, from 3s. 10d. to 3s. 6d. per 1000 cubic feet.

Beyond the River Mersey and district of New Moston, from 4s. 6d. to 4s. per 1000 cubic feet.

And that the prices charged for gas supplied to the public lamps beyond the city be reduced 2s. 6d. per lamp per annum.

On behalf of the Gas Committee,
Gas Offices, Town-Hall, Oct. 5, 1877. JOHN KING, Jun., Chairman.

PROFIT AND LOSS ACCOUNT.

EXPENDITURE.

To Cannel			£176,828 11 9
Retort men's wages			28,643 9 6
Retorts, materials, and setting			6,145 15 5
Labourers wages and repairs of works—			
Gaythorn station	£3,274 7 11		
Rochdale Road station	10 115 7 3		
Street-mains	4,311 14 11		
Droylsden	164 12 10		
Repairs of hired meters	615 5 9		
		23,481 8 8	
Purifying charges			5,739 14 11
Salaries			10,435 17 2
Collectors poundage, &c.			5,756 4 5
Chief and other rents, rates, and taxes, &c.—			
Chief rents	£366 15 1		
Rates on stations and street-mains	6,940 12 9		
		7,307 7 10	
Income-tax			1,782 11 7
Carried forward			£263,613 1 3

Brought forward			£263,613 1 3
To Amount transferred to capital account for depreciation of works—			
Gaythorn station—			
4 p. ct. on buildings (£65,490 17s. 5d.)	£2,619 12 7		
5 p. ct. on apparatus (£41,864 9s. 2d.)	2,093 4 5		
		£4,712 17 0	
Rochdale Road station—			
4 p. ct. on buildings (£115,978 16s. 0d.)	£4,639 3 0		
5 p. ct. on apparatus (£79,133 8s. 6d.)	3,956 13 5		
		8,595 16 5	
Droylsden works—			
4 p. ct. on buildings (£6009 13s. 3d.)	£240 7 8		
5 p. ct. on apparatus (£6055 17s. 6d.)	302 15 10		
		543 3 6	
Street-mains store (Poland St.)—			
4 p. ct. on buildings (£1427 0s. 8d.)	£57 1 7		
5 p. ct. on apparatus (£346 3s. 8d.)	17 6 2		
		74 7 9	
Street-mains—			
2½ p. ct. on main-pipes (£227,923 3s. 4d.)		5,698 1 7	
Hired meters and fittings—			
10 p. ct. on £43,921 16s. 10d.		4,392 3 8	
Meter-proving apparatus—			
10 p. ct. on £51 18s. 7d.		5 3 10	
			24,021 13 9
Stationery and advertising			694 5 2
Law expenses, stationery, receipt, postage, and deed stamps			239 5 6
Miscellaneous expenses			1,048 2 0
Clothing for inspectors			525 4 6
Subscriptions to Royal Infirmary and Eye Hospital			57 15 0
Bad debts			696 18 0
Balance carried down			100,539 16 7
			£391,436 1 9
Interest on loans			£15,518 2 1
Amount transferred to capital account towards liquidation of mortgage debt			27,729 15 8
Amount retained in repayment of balance of advances made to Improvement Committee in anticipation of profits			8,891 15 10
Portion of surplus payable to Improvement Committee			42,133 16 3
Amount carried to reserve-fund			6,266 6 9
			£100,539 16 7

INCOME.

By Gas-rental—			
Within the city—			
Private consumers	£231,076 4 9		
Meter-rents	3,681 11 7		
Public lamps	14,662 9 1		
		£249,420 5 5	
Beyond the city—			
Private consumers	£76,460 2 2		
Meter-rents	1,486 15 5		
Public lamps	6,373 16 8		
		84,320 14 3	
			£333,740 19 8
Coke			21,740 4 0
Tar		£21,082 12 5	
Ammonia water		14,872 5 8	
			35,954 18 1
			£391,436 1 9
Balance brought down, being the gross profit on the year's working			£100,539 16 7

GENERAL SUMMARY OF RECEIPTS AND EXPENDITURE ON CAPITAL AND REVENUE ACCOUNT.

RECEIPTS.

To Balance in the bank, June 24, 1876		£83,943 10 11	
Ditto in the treasurer's hands, June 24, 1876		522 2 9	
Ditto of sums owing to and by the committee, including stocks on hand, June 24, 1876		66,616 13 10	
			£151,081 7 6
Balance of profit and loss, as per statement			57,291 18 10
Loans received			18 3 4
Materials sold (capital account), as per statement—			
Gaythorn station		£80 5 0	
Rochdale Road station		103 17 8	
			184 2 8
Amount transferred from revenue account—			
For depreciation of works			24,021 13 9
Liquidation of mortgage debt			27,729 15 8
			£260,327 1 9

EXPENDITURE.

By Loans repaid			£28,161 14 11
Improvement Committee—			
Surplus for the year ending June 24, 1876		£56,976 11 5	
Less retained on account of amount advanced in anticipation of future profits		17,565 14 5	
			39,410 17 0
Expenditure on capital account, viz.—			
Gaythorn station		£1,683 11 8	
Rochdale Road station		7,233 15 8	
Bradford Road works		24,593 11 7	
Street-mains store		31 10 0	
Street-mains		14,885 2 2	
Service-pipes (one moiety)		1,127 16 8	
Hired meters		10,746 17 10	
			60,302 5 7
Balance in the bank, June 24, 1877		£71,591 18 7	
Ditto in the treasurer's hands, June 24, 1877		941 15 9	
			72,533 14 4
Ditto of sums owing to and by the committee, including stocks on hand, June 24, 1877			59,918 9 11
			£260,327 1 9

STATEMENT OF ASSETS AND LIABILITIES.

PERMANENT ASSETS.

Gaythorn station—			
Land, buildings, and apparatus, as per last report—			
Land	£60,467 16 10		
Buildings	65,490 17 5		
Apparatus	41,864 9 2		
		£167,823 3 5	
Less—			
Materials sold	£80 5 0		
Depreciation	4,712 17 0		
		4,793 2 0	
		£163,030 1 5	
One year's outlay to June 24, 1877—			
Experimental apparatus	£110 16 0		
New condenser	1,217 14 2		
Office furniture	3 18 0		
Paving yard	351 3 6		
		1,683 11 8	
			£164,713 13 1
Carried forward			£164,713 13 1

Brought forward			£164,713 13 1
Rochdale Road station—			
Land, buildings, and apparatus, as per last report—			
Land	£31,805 4 10		
Buildings	115,978 16 0		
Apparatus	79,133 8 6		
		£226,917 9 4	
Less—			
Materials sold	£103 17 8		
Depreciation	8,595 16 5		
		8,699 14 1	
		£218,217 15 3	
One year's outlay to June 24, 1877—			
No. 1 retort-house	£231 8 0		
,, 3 ditto	165 10 0		
,, 4 ditto	211 17 6		
Purifying shed	12 4 6		
Offices	6 1 6		
Cannel stores	28 0 6		
Tramway	142 19 6		
Exhauster register	35 2 4		
Experimental apparatus	45 16 6		
New boiler	658 1 2		
Yard mains	6 12 1		
Coolers	61 3 0		
Hydraulic apparatus	5,628 19 1		
		7,233 15 8	
			225,451 10 11
Droylsden station—			
Land, buildings, and apparatus, as per last report—			
Land	£828 17 3		
Buildings	6,009 13 3		
Apparatus	6,055 17 6		
		£12,894 8 0	
Less depreciation		543 3 6	
			12,351 4 6
Bradford Road station—			
Land, as per last report		£34,975 9 9	
One year's outlay to June 24, 1877—			
River wall	£16,569 10 5		
Retort-houses	1,002 19 6		
Canal basin	24 10 8		
Gasholder-tanks	4,882 14 5		
Weigh-bridge	75 12 5		
Premiums for designs submitted in competition for the new works; engineer's fees and architects commission	1,816 13 0		
Miscellaneous expenses	221 11 2		
		24,593 11 7	
			59,569 1 4
Street-mains store (Poland Street)—			
Land, buildings, and apparatus, as per last report—			
Land	£1,406 0 0		
Buildings	1,427 0 8		
Apparatus	346 3 8		
		£3,179 4 4	
Less depreciation		74 7 9	
		£3,104 16 7	
One year's outlay to June 24, 1877—			
Testing apparatus		31 10 0	
			3,136 6 7
Street-mains—			
Main-pipes, as per last report	£227,923 3 4		
Less depreciation	5,698 1 7		
		£222,225 1 9	
One year's outlay to June 24, 1877		14,885 2 2	
			237,110 3 11
Service-pipes—			
Service-pipes laid, as per last report		£24,873 11 2	
Moiety of one year's outlay, charged to capital account		1,127 16 8	
			26,001 7 10
Hired meters, &c.—			
Outlay, as per last report	£43,921 16 10		
Less depreciation	4,392 3 8		
		£39,529 13 2	
One year's outlay to June 24, 1877		10,746 17 10	
			50,276 11 0
Meter-proving apparatus—			
Outlay, as per last report		£51 18 7	
Less depreciation		5 3 10	
			46 14 9
			£778,656 13 11

FLOATING ASSETS.

Cannel, retorts, and other materials on hand	£47,374 3 1	
Gas-rents and sundry accounts due to the committee—		
Revenue account	72,747 9 7	
Extension ditto	629 19 10	
Amount paid in advance to Improvement Committee	8,891 15 10	
Balance in the bank	71,591 18 7	
Ditto in the treasurer's hands	941 15 9	
		202,177 2 8
		£980,833 16 7
Excess of assets, June 24, 1877	£483,599 12 8	
Ditto of assets, June 24, 1876	455,869 17 0	
Increase, being the amount charged upon profit and loss for the present year towards liquidation of the mortgage debt, and carried to capital account		£27,729 15 8

LIABILITIES.

Mortgage—			
Act of 1844—1st charge	£67,841 0 9		
Ditto 1844—2nd charge	16,268 12 2		
Ditto 1854	32,710 0 0		
Ditto 1858	51,155 0 0		
Ditto 1867	174,152 16 1		
Consolidated stock, 1875	30,434 0 0		
Total amount secured by mortgage		£372,561 9 0	
Sums advanced not secured by mortgage		4,797 13 6	
			£377,359 2 6
Purchase of land, the purchase-money being left in the hands of the committee at interest			1,750 0 0
Sundry accounts owing—			
Revenue account			31,565 16 8
Extension ditto			11,784 12 4
Deposits in hand			17,482 13 7
Surplus for the year ending June 24, 1877, payable to the Improvement Department		£42,133 16 3	
Amount carried to reserve-fund		6,266 6 9	
Retained in repayment of balance of advances made to the Improvement Committee, in anticipation of profits		8,891 15 10	
			57,291 18 10
Balance, being excess of assets			483,599 12 8
			£980,833 16 7

[APPENDIX A.]

Statement of the Lamp and Private Rental (including Meter-Rents) derived from Townships within and beyond the City respectively, for the Years 1875-76 and 1876-77.

	Half Year ending Dec. 25, 1875.			Half Year ending June 24, 1876.			Total for the Year 1875-76			Half Year ending Dec. 25, 1876.			Half Year ending June 24, 1877.			Total for the Year 1876-7.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Within the city—																		
Township of Manchester—																		
Private rental	72191	5	7	73628	4	7				71119	14	11	71686	1	2			
Public lamps	3461	8	10	3674	13	10				4097	6	10	3773	1	5			
	75652	14	5	77302	18	5				75217	1	9	75459	2	7			
Other townships—																		
Private rental	45950	13	4	46325	2	11				46315	7	11	45636	12	4			
Public lamps	3317	8	7	3358	9	9				3381	5	4	3410	15	6			
	49268	1	11	49683	12	8				49696	13	3	49047	7	13			
Total within the city	124920	16	4	126986	11	1	251907	7	5	124913	15	0	124506	10	5	249420	5	5
Beyond the city—																		
Private rental	38259	1	5	38238	13	2				39605	18	10	38340	18	9			
Public lamps	2903	1	2	3022	0	1				3129	2	11	3244	13	9			
Total beyond the city	41162	2	7	41260	13	3	82422	15	10	42735	1	9	41585	12	6	84320	14	3
Gross rental	166082	18	11	168247	4	4	334330	3	3	167648	16	9	166092	2	11	333740	19	8

Within the city: Gross rental (1875-76) £251,907 7s. 5d.; ditto (1876-77) £249,420 5s. 5d.; decrease, £2,487 2s. 0d. Beyond the city: Gross rental (1875-76) £82,422 15s. 10d.; ditto (1876-77) £84,320 14s. 3d.; increase, £1,897 18s. 5d. Total: Gross rental (1875-76) £334,330 3s. 3d.; ditto (1876-77) £333,740 19s. 8d.; decrease, £589 3s. 7d.

[APPENDIX B.]

Comparative Statement of the Quantity of Gas transmitted from the Works, in the Daytime and during the Twenty-four Hours, for the Years 1875-6 and 1876-77.

	DAYTIME.				TWENTY-FOUR HOURS.			
	1875-76.	1876-77.	Increase.	Decrease.	1875-76.	1876-77.	Increase.	Decrease.
	Cubic Feet.	Cubic Feet.	Per cent.	Per cent.	Cubic Feet.	Cubic Feet.	Per cent.	Per cent.
July	22,564,000	17,836,000	....	20·95	82,627,700	72,881,900	....	11·79
August	22,452,900	23,392,700	4·18	....	97,407,900	109,270,700	12·17	....
September	23,472,400	25,544,900	8·82	....	123,217,000	127,839,600	3·75	....
October	34,836,500	31,110,000	....	10·69	181,908,800	170,110,100	....	6·48
November	43,016,000	53,517,000	24·41	....	232,695,800	286,478,000	23·11	....
December	53,926,600	50,766,000	....	5·86	281,128,600	268,185,000	....	4·60
January	51,829,300	46,461,000	....	10·35	265,866,000	253,867,000	....	4·51
February	42,494,500	40,246,000	....	5·29	218,964,400	220,967,000	0·92	....
March	38,404,900	45,402,000	18·22	....	180,604,400	217,042,000	20·17	....
April	28,164,100	31,686,000	12·50	....	124,795,400	131,510,000	5·38	....
May	25,893,000	33,477,000	29·28	....	104,192,000	127,832,000	22·68	....
June	21,194,800	23,907,000	12·80	....	79,288,000	84,112,000	6·08	....
Total	408,249,000	423,345,600	3·09	....	1,972,696,000	2,070,115,300	4·93	....

During the daytime (1875-76) 408,249,000 cubic feet; (1876-77) 423,345,600 cubic feet; increase, 15,096,600 cubic feet. During the twenty-four hours (1875-76) 1,972,696,000 cubic feet; (1876-77) 2,070,115,300 cubic feet; increase, 97,419,300 cubic feet.

[APPENDIX C.]

Table showing the Number of each Size of Meters in use on June 24, 1876 and 1877, respectively.

Size of Meters.	Townships within the City.														Townships beyond the City.		Total.		Increase.	Decrease.
	Manchester.		Chorlton-on-Medlock.		Hulme.		Ardwick.		Beswick.		Cheetham.		Total within the City.							
	1876.	1877.	1876.	1877.	1876.	1877.	1876.	1877.	1876.	1877.	1876.	1877.	1876.	1877.	1876.	1877.	1876.	1877.		
1 light	26	21	9	8	7	10	6	6	..	..	1	..	49	45	19	16	68	61	..	7
2 lights	10986	10823	3685	3588	6597	6502	2589	2551	495	524	1496	1429	25848	25417	9610	9817	35458	35234	..	224
3 ,,	3974	4248	2632	2911	2372	2453	780	813	118	132	1339	1398	11215	11955	4695	5626	15910	17581	1671	..
5 ,,	2691	2734	1798	1913	784	847	379	388	47	47	939	978	6638	6907	3241	3715	9879	10622	743	..
10 ,,	1711	1717	562	566	249	264	139	137	12	16	289	292	2962	2992	1206	1319	4168	4311	143	..
15 ,,	1	1	..	..	..	..	..	..	..	..	..	..	1	1	..	..	1	1	..	..
20 ,,	993	1041	171	168	106	114	53	57	3	3	68	66	1394	1449	416	467	1810	1856	46	..
30 ,,	431	466	56	46	38	37	13	14	3	4	29	33	570	600	134	148	704	748	44	..
45 ,,	35	39	3	3	2	2	2	2	..	..	..	..	42	46	9	8	51	54	3	..
50 ,,	300	330	24	17	17	23	15	17	2	2	18	20	376	409	82	100	458	509	51	..
60 ,,	125	127	8	13	15	14	2	2	..	..	9	8	159	164	23	25	182	189	7	..
80 ,,	102	114	8	9	11	12	4	5	..	..	1	1	126	141	18	22	144	163	19	..
100 ,,	165	170	10	10	7	5	6	7	1	1	7	7	196	200	47	48	243	248	5	..
150 ,,	55	52	6	8	7	7	5	5	..	..	2	2	75	74	14	17	89	91	2	..
200 ,,	18	27	4	4	3	3	2	2	..	..	3	3	30	39	14	14	44	53	9	..
250 ,,	5	3	..	..	1	..	..	..	1	1	..	..	6	5	..	1	6	6	..	..
300 ,,	17	18	4	5	3	2	..	..	..	..	3	3	27	28	15	14	42	42	..	..
500 ,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1	1	..	..
600 ,,	3	3	..	..	..	..	..	..	..	..	..	..	3	3	..	..	3	3	..	..
1000 ,,	1	1	..	..	..	..	..	..	..	..	..	..	1	1	1	1	2	2	..	..
Total	21639	21935	8980	9269	10218	10296	3995	4006	682	730	4204	4240	49718	50476	19545	21299	69263	71775	2743	231

Total increase, 2743. Deduct decrease, 231; net increase, 2512 meters.

Statement showing the Number and Size of Meters on Hire on June 24, 1877 (included in the above Table).

	1 Light.	2 Lights.	3 Lights.	5 Lights.	10 Lights.	20 Lights.	30 Lights.	50 Lights.	60 Lights.	80 Lights.	100 Lights.	150 Lights.	Total, 1876.	Total, 1877.	Increase. 1877.
Within the city	44	15010	7038	3286	862	241	68	41	18	7	15	1	23805	26631	2826
Beyond the city	8	3846	3667	2075	386	30	12	8	6	1	8	..	7813	10041	2228
Total	52	18850	10705	5361	1248	271	80	49	24	8	23	1	31618	36672	5054

[APPENDIX D.]

Gas-Mains Laid and Taken Up during the Year ending June 24, 1877.

LAID.	Diam. 2 in.	Diam. 3 in.	Diam. 4 in.	Diam. 5 in.	Diam. 6 in.	Diam. 8 in.	Diam. 9 in.	Diam. 12 in.	Diam. 30 in.	Total Length.	Remarks.
Townships within the city—	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	
Manchester	2408	1462	445	..	260	110	..	..	56	4741	
Hulme	54	358	..	..	..	..	..	..	..	412	
Chorlton-upon-Medlock	554	457	..	..	..	..	..	..	..	1011	
Cheetham	281	104	9	..	44	..	..	..	..	438	
Ardwick	229	18	15	..	121	..	..	20	..	403	
Beswick	611	51	..	..	..	..	..	..	..	662	
	4137	2450	469	..	425	110	..	20	56	7667	Yards laid— Within the city.
Townships beyond the city	9054	5468	1441	..	841	2234	11	747	939	20735	Beyond the city.
Total	13191	7918	1910	..	1266	2344	11	767	995	28402	During the year.
										Being 16 miles and 242 yards.	
TAKEN UP.											Yards taken up—
Townships within the city	691	750	90	95	130	14	10	..	..	1780	Within the city.
Townships beyond the city	801	716	1073	..	12	..	..	..	..	2602	Beyond the city.
Total	1492	1466	1163	95	142	14	10	..	..	4382	During the year.
										Being 2½ miles and 422 yards.	
Laid during year 1876-77	13191	7918	1910	..	1266	2344	11	767	995	28402	
Taken up during year 1876-77	1492	1466	1163	95	142	14	10	..	..	4382	

Net increase during the year ending June 24, 1877 . . . . 24,020 yards. Total net increase during the year . . . . . 13½ miles and 260 yards.

[APPENDIX D—*continued.*]

Summary.

	Diam. 2 in.	Diam. 3 in.	Diam. 4 in.	Diam. 5 in.	Diam. 6 in.	Diam. 7 in.	Diam. 8 in.	Diam. 9 in.	Diam. 10 in.	Diam. 11 in.	Diam. 12 in.	Diam. 13 in.	Diam. 14 in.	Diam. 15 in.	Diam. 16 in.	Diam. 17 in.	Diam. 18 in.	Diam. 20 in.	Diam. 22 in.	Diam. 24 in.	Diam. 30 in.	Total Length
Pipes laid to June 24, 1876—	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.
Within the city. . .	256084	123463	50976	14853	31333	738	15227	13496	1456	279	29599	309	7222	4978	3993	55	5811	324	477	6799	2520	569992
Beyond the city. . .	143148	61684	54364	6594	31438	410	25703	13702	1327	1808	20393	..	749	305	..	..	4031	..	..	315	..	365971
Pipes laid during the year ending June 24, 1877—	399232	185147	105340	21447	62771	1148	40930	27198	2783	2087	49992	309	7971	5283	3993	55	9842	324	477	7114	2520	935963
Within the city . . .	4137	2450	469	..	425	..	110	..	..	..	20	..	..	..	..	..	..	..	..	..	..	56 7667
Beyond the city. . .	9054	5468	1441	..	841	..	2234	11	..	..	747	..	..	..	..	..	..	..	..	..	..	939 20735
Deduct pipes taken up during the year	412423 1492	193065 1466	107250 1163	21447 95	64037 142	1148 ..	43274 14	27209 10	2783 ..	2087 ..	50759 ..	309 ..	7971 ..	5283 ..	3993 ..	55 ..	9842 ..	324 ..	477 ..	7114 ..	3515 ..	964365 4382
Total	410931	191599	106087	21352	63895	1148	43260	27199	2783	2087	50759	309	7971	5283	3993	55	9842	324	477	7114	3515	959983

Total, 959,983 yards, or 545¼ miles and 343 yards.

[APPENDIX E.]

Statement showing he Amount of Gross Profit, and the Mode of its Appropriation; also the Amount of Borrowed Money Owing, and the Excess of Assets, &c., from the Year 1862 to the present Date.

Year ending June 24.	Profits.	Maximum Price of Gas per 1000 Feet, within the City.	Appropriation of Gross Profits.			Amount advanced to Improvement Committee in anticipation of Profits.	Paid over for Improvement Purposes.	Retained towards Repayment of Advances made to the Improvement Committee in anticipation of Profits.	Carried to Reserve-Fund to meet future Contingencies.	Balance owing of Amounts advanced in anticipation of Profits.	Borrowed Money Owing.	Amount charged to Revenue in respect of Depreciation of Works and Mains.	Excess of Assets.
			Interest.	Liquidation of Mortgage Debt.	Surplus.								
	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1862	42667 7 1	. . . . 4 0	15482 3 2	19330 14 4	7854 9 7	....	7854 9 7	....	....	....	382539 7 10	12179 4 11	126591 4 6
1863	55804 12 9	Half year 4 0 ,, 3 9	14932 17 8	18609 17 4	22261 17 9	....	22261 17 9	....	....	....	362877 8 10	12666 18 11	145201 1 10
1864	59545 18 9	Half year 3 9 ,, 3 6	13888 12 10	17810 1 0	27847 4 11	....	27847 4 11	....	....	....	335808 16 9	12690 12 9	163011 2 10
1865	56432 4 5	Half year 3 6 ,, 3 2	13086 10 9	17587 0 11	25758 12 9	....	25758 12 9	....	....	....	306931 2 2	13050 6 6	180598 3 9
1866	52553 2 10	. . . . 3 2	13252 13 0	19784 2 0	19516 7 10	....	19516 7 10	....	....	....	347472 2 11	13817 2 9	200382 5 9
1867	47323 0 4	. . . . 3 2	14167 11 7	19898 0 4	13257 8 5	....	13257 8 5	....	....	....	331725 9 7	14628 8 6	220280 6 1
1868	49546 4 7	. . . . 3 2	14314 17 9	20246 0 5	14985 6 5	13059 8 5	28044 14 10	....	....	....	351035 10 4	15173 2 5	239685 15 6
1869	52736 18 4	. . . . 3 2	15467 12 6	22688 14 4	14580 11 6	11303 19 8	25884 11 2	....	....	24363 8 1	393469 8 5	15387 15 7	262374 9 10
1870	65343 10 8	. . . . 3 2	16784 13 8	24487 6 0	24071 11 0	3750 0 0	27821 11 0	....	....	28113 8 1	432941 1 9	17633 5 10	286861 15 10
1871	79322 9 5	. . . . 3 2	18329 0 5	27050 15 11	33942 13 1	....	28020 11 11	5922 1 2	....	22191 6 11	448593 9 5	19602 10 5	313912 11 9
1872	63257 9 7	. . . . 3 2	18539 19 6	27805 15 11	16911 14 2	13293 10 3	30205 4 5	....	....	35484 17 2	459593 9 5	22283 6 8	341718 7 8
1873	63603 0 6	One Qr. 3 2 Three ,, 3 4	18413 7 1	28588 19 6	16600 13 11	16641 11 6	33242 5 5	....	....	52126 8 8	460640 11 0	22614 18 6	370307 7 2
1874	77465 12 2	Half Year 3 4 ,, 3 8	18861 13 3	28977 9 6	29626 9 5	183 9 4	29809 18 9	....	....	52309 18 0	457834 5 0	22849 4 5	399284 16 8
1875	106807 6 5	. . . . 3 8	17182 18 8	28514 17 11	61109 9 10	....	35257 2 1	25852 7 9	....	26457 10 3	432310 2 0	22908 7 0	427799 14 7
1876	101232 4 6	Half Year 3 8 ,, 3 6	16185 10 8	28070 2 5	56976 11 5	....	39410 17 0	17565 14 5	....	8891 15 10	405502 14 1	23491 15 7	455869 17 0
1877	100539 16 7	Half-year 3 6 ,, 3 4	15518 2 1	27729 15 8	48400 3 0	....	42133 16 3	8891 15 10	6266 6 9	....	377359 2 6	24021 13 9	483599 12 8
Tot.	1074180 18 11	....	254408 4 7	377179 13 6	433701 5 0	....	436326 14 1	....	....	....	....	284998 14 6	...

NORTH OF ENGLAND GAS MANAGERS ASSOCIATION.

On Saturday, Oct. 27, the First General Meeting of this Association, since its formation in April last, was held in the Board-Room of the Newcastle and Gateshead Gas Company, Newcastle-on-Tyne.

The PRESIDENT (Mr. W. J. Warner, of South Shields) occupied the chair; there was a numerous attendance, and fifteen additional members and associates were added to the Association.

The PRESIDENT delivered the following opening address:—

Gentlemen,—Our meeting to-day is in accordance with the 8th and 9th resolutions passed at a meeting of gas managers held at South Shields on the 10th of April last. A part of the 9th resolution is—"The next general meeting to be held on a day in October, to be fixed by the committee."

The 8th resolution is—"The office-bearers shall take office immediately after this meeting, and will proceed at once to draw up a constitution embracing all matters not decided in the resolutions passed at this meeting; such as the management of the Association, the duties of office-bearers, proceedings of meetings, and election of new members and officers, and report the same to the next general meeting."

This, then, is *the* business of to-day—the giving to your committee of a constitution to carry out the objects of this Association. In drawing up the regulations, we felt it desirable to have them as short and as simple as possible, and, therefore, have not encumbered them by defining the routine duties of the officers, and such-like matters. The business is simple, the rules for the regulation of it should be the same.

It is my duty to propose the adoption of the regulations which have been submitted to you for this purpose, but before doing so I will take a retrospective glance at the formation of kindred associations, point out the difference in the objects aimed at by the several associations, and direct your attention to the advantages of such associations.

The first persons, I believe, who associated themselves together for the advancement of gas matters were London gas-fitters; the name of the association was "The Gas-Fitters Mutual Association," and was formed in 1850, the president being Mr. George Detheridge, now one of the meter inspectors of the Metropolitan Board of Works. Some of the committee are known to you by name, being other than gas-fitters, such as the late Mr. N. Defries and Mr. D. Cowan. "The objects of the association are" (and I venture to give you the whole of theirs as printed in the rules) "to advance the interests of its members by a mutual interchange of opinion, and by all other practicable means, to enable them to obtain the best information on the various projects before the public now, or which may at any time be laid before them, as to the advantage likely to be gained by the community at large from inventions put forward as improvements, and having a tendency to give an impetus to the more extensive consumption of gas, and the more perfectly burning that light in private houses; to encourage the general adoption of gas for culinary and other purposes, or its extended use in processes of manufacture; and to acquire information on the simplest and most efficacious modes of ventilation in connection with that mode of lighting, and generally to disseminate useful information on all matters connected with gas lighting to its members, and through them to the public, on the application of this most important of modern discoveries to other purposes than those for which it has hitherto been used." "All persons connected with the manufacture of gas and gas apparatus, or interested in the advancement of gas lighting," were eligible as members. "Subscription, one guinea per annum." The meetings—"second Tuesday in each month, or at such time as appointed." The committee consisted of 12 members. Papers were read and lectures given, and an exhibition of gas apparatus took place at the Polytechnic Institution, London, in 1851, through the instrumentality of the association, assisted by some of the leading London engineers. The companies subscribed to a fund raised for the purpose, the Imperial giving the largest amount, £100. The title of this association was modest and unassuming, though the objects aimed at were pretentious; still, excellent work was done during the short time of its existence, for I find no reference to its meetings after April, 1851. Some of our best men identified themselves with its proceedings. Mr. Lewis Thompson, Mr. Alexander Wright, Mr. Keates, Dr. Bachhoffner, Mr. Gore, &c., some of whom I had the pleasure of listening to, and most excellent lectures they were.

It was at some of these meetings, I believe, that Mr. Wright first made public his bisulphide of carbon apparatus.

We are also indebted to this association for the prize essay on coal gas by Mr. Lewis Thompson. It is remarkable that the advantages of such an association to gas managers were not appreciated for twelve years after this, and then, in so far distant and unimportant a place—unimportant in the gas world—as the county of Fife. In 1862 the North British, or "The Association of Gas Managers of the Counties of Fife, Kinross, Perth, and Forfar," was originated, I may almost say by Mr. W. Mackenzie, of Dunfermline, who has been its secretary ever since. Twenty-one members joined at the first meeting, but it now numbers about 150 members altogether.

The publication in the JOURNAL OF GAS LIGHTING of the proceedings of the Association, coupled with the knowledge I had of the work of the Gas-Fitters Association, drew forth my letter to the same JOURNAL proposing the formation of a British Association. This suggestion, as you know, was acted upon, the first meeting being held at Manchester under the presidency of the late Mr. Adamson, 24 persons being present. There are now 649 members in all, with a revenue of £450. The Manchester District Association of Gas Engineers was formed in 1869, and numbered 14 members, but it has now about 50 on its roll. Its name, I understand, is to be changed to "The Manchester Institution of Gas Engineers." In 1872 "The West of Scotland Association of Gas Managers" was formed. At the first meeting there were 12 members present, but there are now about 200 on its books. "The Southern District Association of Gas Engineers and Managers" was formed in 1875 by seven members; it now numbers 37.

"The North of England Association" mustered a larger number than any other at its first meeting—40 persons. There is also another association in the course of formation, for the Birmingham district.

Now, as to the *object* of the several associations—it cannot be better expressed, I think, than in the words of Mr. Mackenzie, for he it was, I believe, who drew up the "Regulations" for "The North British Association," and these regulations appear to be the basis on which all the others have been framed. The section stands thus:—"This association of gas managers shall devote itself to the encouragement and advancement of all matters connected with gas engineering and manufacture, being established to facilitate the exchange of information and ideas amongst its members." This section stands the same in the regulations of the British Association, with the exception of "Finance" being added to "Manufacture."

We have framed ours nearly the same, but have added the words "Distribution of gas and its products."

The West of Scotland Association differs from all the others, it having "a managers fund in connection with the Association." There are also differences in the constitutions of the several associations.

The North British, the British, and the West of Scotland Associations are composed of "ordinary, extra-ordinary, and honorary members;" the North of England Association, of "members and associates," but the Manchester and Southern District Association have only members, and they consist entirely of engineers and managers. In this matter these two differ, however; the latter is for those connected with the "Southern Counties," but the Manchester is open to *all* "engineers and managers of gas-works, employed by gas companies or corporations."

As to meetings, the North British and the British are annual; West of Scotland and North of England bi-annual; and the Manchester and Southern District annual, with general meetings in May, August, and November. The West of Scotland publishes an annual statistical report relative to the gas supply of Scotland, in this differing from all the other associations.

With regard to the advantages of these associations, Mr. Longworth, the late worthy secretary of the Manchester District Association, in a letter to me some time since, said: "Every member present is bound to take part in the discussions, so you see every member is obliged to read himself up on the subject matter before the meeting; we have perfect friendship in all our transactions." Mr. Chapman, the secretary of the Southern District Association, says: "We have found great benefit from meeting together and talking over different matters, as well as from the papers under discussion." The secretary of the West of Scotland Association, Mr. Robert S. Carlow, bears also similar testimony. He says: "Members get the latest and most improved system of conducting their works, and also gain the great amount of valuable information that is to be derived by holding these meetings. The amount of benefit derived from this association is very great;" this is exclusive of the benefits from the benevolent-fund. But Mr. W. Mackenzie, who has been 15 years secretary of the North British Association, and whom we may consider to be the father of these associations, speaks still more emphatically. In a most interesting letter to me, he says: "The benefits derived by members have, I know, been great, and, speaking for myself, I can say that I leave our meetings invariably carrying with me some lasting benefit, and with fresh stimulus to begin the winter campaign." To give you another quotation from the letter will almost appear to carry me from this point, but really not so. He says: "I would suggest to you, in beginning a new association, to make an effort to enlist the sympathies of directors and gas commissioners in the work and objects of the association. Ultimately, of course, the benefits are reaped by them and their constituents."

This is a matter which has now received attention some little time, and very properly so. It is old ground, I may almost say, and I would rather not walk over it. I may—indeed, it is my duty to—direct attention, however, to the experience of these secretaries as to the advantages of these associations; but this is all I can do. No words of mine will add force to what Mr. Mackenzie says: "I leave our meetings invariably carrying with me some lasting benefit." Surely no company or corporation can, after this, withhold from a manager the means and opportunity of availing himself of such advantages, and do justice to the undertaking. It is necessary that the man as well as the plant committed to his care, should be in the best possible working condition; he should know whether others are getting more gas per ton of coal than he is, and if so how; he should know whether he is bringing as much gas to book of what he makes as his neighbours, and if not, why.

But is it possible for a manager to obtain this information and knowledge in any other way than by attending the meetings of such associations? I think not. It is true the papers are published, and the discussion too; but there is an under-current flowing through the meetings of more value to the members of the associations than all that is published—the after-thoughts and the experience and opinion of those who never take part in the public business of the meetings. For some around me, representatives of companies and corporations, as well as for myself, I can say that this matter does not personally concern us; but there are others—managers of small works and in out-of-the-way places—who must feel keenly the inequality of their position in this respect; hence the efforts made to "enlist the sympathies of directors and commissioners in the work and objects of the associations." You will see, from the last number of the JOURNAL OF GAS LIGHTING, that these efforts have not been fruitless, as Mr. Lennox, one of the directors of the Helensburgh Company, spoke decidedly upon the point: "I think it is the duty of directors of gas-works to encourage such meetings."

For a time I was jealous of district associations; I was fearful that they would prejudice the position of the British Association, that they would have a tendency to weaken it, and so lower its tone rather than elevate its character. But, upon a closer examination of the subject, I must admit I hold the opposite opinion. I believe district associations will strengthen, rather than weaken, it; and that if these are not as large, there are as important spheres of usefulness for them as for the British Association; and that they will act and react upon each other, elevating the character of the working members, and raising the professional tone of their more fortunate, if not more gifted, brethren. One is the complement of the other. These districts will be so many technical schools, through which many of their members will pass on to what will become an *institute*, the constitution of the British Association being changed to meet the progressive requirements of our profession. The districts taking to themselves *all* who hold positions of trust and responsibility in gas-works, the institute being open only to those winning a position by their professional attainments. For the development of this it will be necessary, however, to have a common bond of union, binding the district associations to the British Association, but without restraining their freedom of action, or lessening their power of self-control. Even as we are at present constituted, I think the British and the district associations might be eventually benefited by an arrangement for printing the transactions of the whole together yearly; by having a benevolent-fund in common; by offering higher premiums for papers and communications; and by the joint publication of carefully-prepared statistical papers.

But, gentlemen, in dwelling upon the advantages which these associations offer to gas managers, and those immediately connected with them, should we not take higher ground than the personal benefits which the associations confer upon their members? Do not the managers of such undertakings—and in using the word "managers" I do so in no limited sense, confining it not to those who have direct charge of the works—do not the managers, then, I ask, owe a duty to the vast undertakings committed to their charge, to be in possession of the fullest amount of information affecting it? Look at the counties just associated; see the large district which we cover, in area about one-seventh of the whole of England, and yet what have we had in common one with the other, but the common calling, the common business? Again, take the capital employed in this district, and we see still more clearly the importance of having a common interest in a common calling. Approximately there must be from three to four millions invested in gas-works in the "North of England district," and yet we know little or nothing more of the working of this vast amount of capital than the public. By your united action this state of things will now cease; we shall be brought in direct communication one with the other, and the principal towns, at least, will be visited in succession, as these towns were represented at our first meeting; 21 of those that were present represented—it will be gratifying to you to learn—fully a million and a half of capital.

At the close of his address the PRESIDENT read the following note received by him from the Secretary of the British Association of Gas Managers respecting the advantages of similar institutions:—"I can only speak positively in respect to the parent Association, but I think that if any one had watched with the same interest as I do, they would only support me in saying that the Association has done more towards the spread of technical and practical knowledge, such as managers require to be posted in, than all other means put together. I do not mean to say that this has been wholly done by the reading of papers at our meetings; at the same time I do not wish to be thought as speaking disparagingly of them, but by means of the Association, men have become acquainted with one another and their doings, and are not now, as formerly, deterred from writing to one another for information without a formal introduction, their being members of the same Association is sufficient to guarantee their *bona fides* and ensure responses, which are often of the greatest value. I have hundreds of letters every year in reference to matters quite outside the ordinary routine letters of an Association, and feel a pride in being able frequently to assist those who, from force of circumstances, are not so advantageously placed for the acquirement of information upon particular subjects. I do not think any one knows better than I do the worth of such an institution."

Mr. J. HEPWORTH (Carlisle) proposed a cordial vote of thanks to the President for his address, to which he said he had listened with very much pleasure, and for which he expressed his obligations and those of the members.

Mr. J. H. COX said he had great pleasure in seconding the vote of thanks, and it was carried by acclamation.

The meeting then proceeded to consider and settle a code of regulations for the government of the Association.

It was decided to hold the next meeting at Newcastle, on the last Saturday in April.

After the meeting, the members of the Association proceeded to the Redheugh Gas-Works, which they inspected, and subsequently partook of luncheon provided by the gas company in the meter-house. Alderman Hedley (chairman of the board of directors of the Newcastle and Gateshead Gas Company) occupied the chair, and the vice-chair was filled by Mr. W. B. Wilkinson (director of the company), and Mr. William Hardie (secretary). Among those present were Alderman Plummer and Mr. Douglas, directors of the gas company.

The CHAIRMAN, after proposing the health of the Queen, said that his colleagues in the directorate of the gas company and himself were pleased to meet so many gentlemen who were connected with the management of gas-works in the North of England; and he was glad to know that they had formed themselves into an Association, called the North of England Gas Managers Association. The Association was in its infancy, but he hoped it would become of great importance in a few years time. He proposed "Success to the Association," and coupled the name of Mr. Warner with the toast.

Mr. WARNER, in responding, said they could have come to no works upon the occasion of this first meeting together, in which they could see such a good model to study as the Redheugh works. They had seen how thoroughly well conducted those works were, and the directors of the company were entitled to their thanks for permitting them to see through the works, for allowing the meeting to be held in their board-room, and for entertaining them. He proposed the health of the directors, and "Success to the Newcastle and Gateshead Gas Company."

The CHAIRMAN said it had given the directors great pleasure to receive the members of the Association that day. He had been connected with the Newcastle and Gateshead Gas Company for many years, and the directors had had times of anxiety; but he was glad to say that the time of high prices for coals was passed, and they were now going on in the old-fashioned way of getting coals at the old prices. The directors depended upon their managers, and it was most satisfactory to know that they had gentlemen to manage the works who would attend to the interests of the shareholders and directors. Their works had been prosperous, and the extensions were very large. The increase in the consumption of gas was at the rate of about 10 per cent. every year and the result was that they had in about eight years to supply double the quantity of gas they formerly did. The directors had to look ahead, and have works capable of meeting the increasing demand as it came upon them. He often wondered what would become of the gas companies when the electric light took the place of gas. He feared there was something in that matter, and he had no doubt the electric light would in a short time be used for lighting large buildings, and well-informed people said that in the course of 20 years it would be used in dwelling-houses.

Mr. WARNER said he had recently read a paper which was published in 1850 on the question of the electric light, and the subject was still much in the same position as it was then.

The CHAIRMAN proposed the health of Mr. Wyatt, whose services, he said, the directors of the Newcastle and Gateshead Company had been fortunate to secure in laying out the new works at Redheugh. When the Redheugh works were commenced, the directors thought they might rest for a while; but they had since then to put in the foundations for another gasholder which would hold 1 million cubic feet of gas; and in time they would have to erect another retort-house.

Mr. WYATT returned thanks, and said they never would have carried out those works without the assistance of Mr. Hardie, who was the life and soul of the undertaking. He did not believe in the electric candle, as was proved by the fact that the Beckton works, with which he was connected, were being made larger. He proposed the health of Mr. Hardie.

Mr. HARDIE responded, and said that everything was done in the Newcastle and Gateshead works to produce gas at the cheapest rate.

The CHAIRMAN proposed the toast of "The managers of the Redheugh and Newcastle Works."

Mr. MOODY and Mr. RIDLEY returned thanks, and the proceedings terminated.

SINGAPORE GAS COMPANY, LIMITED.

An Extraordinary General Meeting of this Company was held at the Cannon Street Hotel, London, on Tuesday, Oct. 23—H. P. STEPHENSON, Esq., in the chair.

The SECRETARY (Mr. R. King) read the notice convening the meeting, and the following reports and statements of account were submitted:—

The directors have to report continued progress in the lighting of Singapore, for particulars of which they refer to the report annexed, from their engineer and manager, Mr. E. J. Wells, dated Aug. 21, 1877.

The balance-sheet to the 30th of June, 1877, appended to this report, shows the financial position of the company. The directors have written off for depreciation of works and plant, and off the expenses of first establishment, as per balance-sheet, at the rate of 1 per cent. per annum. The profit for the half year, after writing off these sums, amounts to £2323 3s. 2d., which together with £626 18s. 3d., the unappropriated profit of the preceding half year, makes the available balance £2950 1s. 5d. Out of this sum the directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, on the amounts called and paid up on the preference and original capital; the balance of £653 11s. 11d. to be carried forward to the profit of the succeeding half year.

The dividend to be payable on Nov. 20.

REPORT OF ENGINEER AND MANAGER.

Gas-Works, Singapore, Aug. 21, 1877.

Gentlemen,—In placing before you my report, showing the working for the half year ending June 30, 1877, I do not deem it necessary to take up your time by going into details as to figures, the balance-sheets having been carefully prepared in the usual way, giving all such details.

Upon the whole, the general working for the half year has been satisfactory. The increase in gas and meter rental over the corresponding half year has been 1127·48 dols.; the returns for coke have been, and will this half year also be, less than usual. This has arisen in consequence of a large quantity of coal, coke, and cinders—say about 24,000 tons—being thrown into the market at low rates, by the salvage sale of the coal partially burnt and damaged by the fire which occurred in April last at Tanjong Pagar Wharf.

In the carbonizing department all is working satisfactorily. The two new benches of retorts, after working nine months, were let down for repairs; these repairs are now completed, and the retorts are ready for use when required.

The process of purification is still working very well. The two new purifiers which it has been decided to erect will be a valuable addition in this department, and their erection will enable me to make a thorough examination of the present purifiers, which have been continuously at work for upwards of 13 years.

The gas has been kept free from impurities, and the standard of illuminating power has been maintained. The engineer's report will furnish you with all the details of coal used, gas made and sold, &c. The leakage of gas, including the quantity consumed on the works, has been 12¾ per cent.

The collection of rental has been satisfactory, 36,795·39 dols. having been collected and paid to bank during the half year. You will note that the item "Bad debts" has increased; this arises from some doubtful accounts being now written off as bad debts.

The fitters have been fully employed during the half year, 46 new houses having been fitted up, and additional lights fitted in other houses to a total of 356. In addition to the ordinary routine work, we shall for the next fortnight be busy erecting fittings for the illuminations for the Chinese Annual Festival.

(Signed) E. J. WELLS, Manager.

Balance-Sheet, June 30, 1877.

Dr.				*Cr.*			
Capital—				Cash at bankers, London and Singapore			
£5 paid on 2000 preference shares	£10,000	0	0		£4,193	12	2
£5 paid on 10,522 ordinary shares	52,610	0	0	Ditto in hands of secretary	1	1	7
£2 paid on 25 ordinary shares	50	0	0	Bills receivable	1,650	0	0
£1 paid on 50 ordinary shares	50	0	0	Office furniture	114	14	6
				Cost of works & plant, as per last statement £34,907 1 10			
				Add extensions during the half year 367 4 2			
				£35,274 6 0			
				Less depreciation at the rate of 1 per cent. per annum 174 10 9			
12,597 shares	£62,710	0	0		35,099	15	3
Debenture bonds	3,900	0	0	Purchase of land	1,118	2	8
Sundry creditors	486	18	3	Retort account	1,213	16	6
Bills payable	1,180	4	1	Stock on hand	12,944	4	9
Insurance reserve-fund	77	3	5	Amounts charged to capital for travelling expenses, rent, preliminary expenses, and interest on capital during construction £10,840 5 11			
Exchange account	250	0	0	Less amount previously written off 850 13 3			
Profit and loss	2,950	1	5	£9,989 12 8			
				Less amount written off this half year, at the rate of 1 per cent. per annum 54 0 0			
					9,935	12	8
				Gas, meter-rental, fittings, and sundries under collection to June 1	2,807	18	4
				Gas, meter-rental, &c., for the month of June, and gas for public lamps for the half year	2,475	8	9
	£71,554	7	2		£71,554	7	2

Profit and Loss Account, from Jan. 1 *to June* 30, 1877.

Coal carbonized	£2,413	5	8	Balance at profit and loss, Dec. 31, 1876	£2,617	14	4
Lime and oxide	20	4	0	Less amount declared as dividend, after deducting income-tax on ordinary and preference shares	2,190	16	1
Trade & general charges	481	19	3		£626	18	3
Rent, rates, and taxes	115	10	2	Gas and meter rental	6,015	0	7
Directors and auditors	210	10	0	Products, profit on fittings, and sundries	1,747	4	0
Salaries and collectors commission	743	8	11				
Wages	411	18	6				
Interest on loans and debentures	145	0	9				
Interest on calls paid in advance	8	10	6				
Exchange account	275	0	0				
Bad debts and allowances	129	3	6				
Retort account	150	0	0				
Meter repairs & renewals	93	19	5				
Depreciation on works and plant, & expenses of first establishment written off	228	10	9				
Office furniture	10	0	0				
Balance—profit for appropriation	2,950	1	5				
	£8,389	2	10		£8,389	2	10

The CHAIRMAN: Gentlemen, in rising to move that the report and balance-sheet be received and adopted, I have to express the regret of the directors that on this occasion we do not present you so favourable an account as we did for the half year ending in December last. This has arisen from several causes, one cause more particularly being the low rate of exchange which has prevailed. For our last remittance we have only received 3s. 11¼d. per dollar instead of 4s. 6d., and, of course, that is a very heavy pull upon our profits. Another cause has been the very large fire which took place at the Tanjong Pagar Wharf, where upwards of 20,000 tons of coal were consumed, some entirely and some partially. The insurers or underwriters of that coal thought fit to sell the whole of the coal, coke, cinders, &c., after the fire, and, of course, as they were disposed of at low rates every one laid in a very large stock. Some sold as low as 2s. 6d. and 5s. per ton, and this has considerably interfered with the disposal of our coke stock for a time. Another cause has been the increased amount of trade and general expenses. This arises from two or three reasons: one is the unfortunately accidental death of one of our chief *employés* who was killed by some machinery—not the result of his own fault—and we had to bear the expense of his funeral and the support of his widow for a time. Another reason was the great drought at Singapore. There was no rainfall to fill our pond, and water for our use had to be brought from a great distance and at considerable expense. These are the causes which have led to the state of affairs I have mentioned. Notwithstanding these, however, we are still able to offer to you the usual dividend of 7½ per cent. per annum, writing off our customary one per cent. for depreciation of plant and on deferred accounts, and carrying forward a small balance—more than the amount of unappropriated profit which we brought from the preceding half year. It will be satisfactory also to you to know that since the close of the half year we have paid £3000 off the debenture bonds. Our debentures will stand in our next balance-sheet at £900 only, and we have very little doubt that as these fall in and become due we shall be able to pay them off, and so clear our balance-sheet of that which is sometimes an advantage, but which we would rather do without if we can. With these remarks, and expressing my willingness to answer any inquiries that may be put to me, I will move the resolution for the adoption of the report.

Mr. FOREMAN seconded the motion, which was put and carried unanimously.

The CHAIRMAN moved—"That a dividend be declared to the ordinary and preference shareholders at the rate of 7½ per cent. per annum, less income-tax, on the amounts paid up on their shares from the respective dates of payment to the 30th of June last, and that such dividends be payable on the 20th of November next."

Mr. RICE seconded the motion, which was put and carried unanimously.

The CHAIRMAN moved a vote of thanks to Mr. Wells, the company's engineer and manager at Singapore, and to the local committee, for the able manner in which they have managed the affairs of the company.

Captain REINECKER seconded the motion, which was cordially adopted.

On the motion of Captain REINECKER, seconded by Mr. WILKINS, thanks were voted to the chairman and directors.

The CHAIRMAN having acknowledged the same,

A vote of thanks was given to the secretary, which Mr. KING having responded to, the proceedings terminated.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

(*Continued from p.* 686.)

After paying a visit to the Helensburgh Gas-Works, Mr. SAMUEL STEWART (Greenock) read the following paper on

THE CONSTRUCTION OF GAS-WORKS.

As requested, I proceed to give you a few notes upon the general arrangements of gas-works, as now considered to include the improvements of the day, and, while making them sufficiently full, I will endeavour to be as concise as possible, avoiding all unnecessary explanations and details, seeing the subject is one upon which you are all well informed.

First, with regard to the plan or arrangement of a gas-works, there are three points that should essentially be considered; these are simplicity of arrangement, economy in working, and general order and cleanliness.

With respect to simplicity, the works should be so arranged that the whole process of manufacture, in all its details, can be readily followed out; the arrangements of the apparatus should be such as to follow each other in a plain and simple manner. All arrangements by which the gas is made to travel backwards and forwards all over the yard should be avoided. The arrangements should be such that the course of the gas from retorts to condensers, exhauster, scrubbers, purifier, station-meter, and gasholders, can be seen, as it were, at a glance; there should be no hiding away, in out-of-the-way corners, of any part of the apparatus; there should be ample room left about and between the apparatus; everything that is possible, including yard mains, should be above ground; all valves, drips, and every other part of the apparatus, should be readily got at; nothing should be hid but what is unavoidable. This is all self-evident, but we all know how lamentably deficient many works are in this respect. Further, I would advise that no apparatus, or detail of apparatus, be adopted that is in any way complicated in its character, or cannot be readily understood by any workman of ordinary intelligence. It is far better about a gas-works, where the process is of necessity continuous, rather to be old-fashioned and simple than to have untried novelties that none but the manager understands.

Economy of working should be considered in planning the works; for instance, the works should be placed as close as possible to a railway, or means by which coals are brought to works, to save cartage. The coal-stores should be situated conveniently to the retort-bench, to save wheeling, and the yard where coke and ashes are stored should be arranged near the retort-house for the same reason. The exhauster boilers should either be in the retort-house or near it. The lime-store should be near the purifiers, and generally every thing or part of the apparatus that involves handling of material should be carefully considered, to see that it is so placed as to cost as little as possible in the handling, and in this simplicity of arrangement will have largely to do.

Cleanliness and order in a works also have a great tendency to economy, and, besides adding to the appearance of a works, tend also very much to the comfort of those employed on them. I hold when a gas-works has been properly planned, it ought, on the whole, to be cleaner and more orderly than the average of public works. The process is particularly a routine one; it is well known when there will be an excess of work, and arrangements made accordingly. It is not like a foundry, an engine-works, or shipbuilding yard, where a press of work may come in unexpectedly. There is no reason, therefore, due to the process of gas manufacture, why gas-works should be the scene of dirt and disorder which they sometimes are, and which make the very name of a gas-works suggest to some people's minds a place to be avoided. I am aware that frequently, where this occurs, it is owing either to a parsimonious feeling on the part of directors, or in consequence of those who either planned or extended the works not having taken the question of cleanliness into consideration.

I shall now proceed to speak in detail of the arrangements of works and apparatus in the various departments of the process of manufacture, and that as shortly as possible, but I would first remark that these notes and opinions have, in the first instance, chiefly reference to the make of cannel gas in Scotland; this differs in some particulars essentially from the practice in England.

First, then, of retort-houses in Scotland. These are usually very narrow and low in the roof, but they should rather be high and wide; not less in width than 20 feet in front of retort-bench, and about 20 feet height of side walls from floor to wall plate. Retort-houses should have an ample ventilation, and be of extra length to allow of extension. The plan

that prevails in some works, of having two or three retort-houses when one would do, is to be avoided, as it prevents economy in working. The coal-stores should be in immediate contact with retort-house, if not under the same roof, or system of roofs, which I prefer, as giving an opportunity of waste heat from the retort-bench drying the coals—a matter of some importance in this climate. By having the coal-stores near to retort-house, there is less labour in bringing coals to the retorts. As coals are usually stacked with us 12 or 15 feet high, it is necessary that the side walls be strong. The practice that exists in many works, of having the coal-stores away from the retort-house, across a yard, and often open and exposed, is very unadvisable, as it frequently causes retorts to be charged with wet coals—a very objectionable thing—and also gives increased labour in wheeling the coals.

With regard to the retort-bench, the practice generally adopted in Scotland is to have three retorts in an oven, and in working three-hour charges this is found most convenient; when four-hour charges prevail, four retorts in an oven are frequently employed; but in England six and seven retorts in an oven is the usual practice, but with three-hour charges this would lead to considerable confusion in the retort-house. In large works, where ground is valuable, it is often necessary, to save space, to have five retorts in one oven; but I believe it will be found that with three-hour charges the three retorts in an oven are, on the whole, quite as economical, and certainly more convenient for the average-sized works in Scotland than any other arrangement. It is now becoming general to use retorts a little longer than formerly—say, up to 9 feet, the average width being about 2 feet by 13 to 15 inches high inside.

The diversity of opinion as to the sizes of retorts and duration of the charges, whether three or four hours, is a subject well worth the consideration of the Association.

We have such a great variety of cannels, probably 150 different kinds, including the shales, which are now being much used, giving yields ranging from 7000 to 13,000 cubic feet per ton, and many of which cannot be efficiently distilled under four hours, it becomes a somewhat difficult thing to fix upon a hard and fast line as to the time the charges should run; but I think experience shows that with cannel coal it is advisable to run the charges as shortly as possible, and that three-hour charges are quite long enough for most cannels, and to do this it is better to put less coal into the retorts rather than have large charges and run them longer than three hours.

When large charges are employed, there is considerable waste of gas during the time of charging, and it also causes a large proportion of the coals to be over-distilled before the whole charge is wrought off, thereby giving rise to the production of considerable quantities of non-illuminating gases, depreciating to a serious extent the average illuminating power of the whole gas made, and further increasing the production of sulphuretted hydrogen and carbonic acid, either of which impurities, should it be present, necessitates, in the first instance, the use of a large quantity of first-class cannels to keep up the quality, and in the second an increased outlay for purification.

It is evident, therefore, that charges of short duration are the more economical, but, as all cannels cannot well be treated in the same way, it would be, I think, of great value to gas managers if a list could be prepared by each member of the Association, giving his opinion of the time he finds it most advantageous to run the charges with the various cannels he is in the habit of using.

In Scotland it is often the practice not to have more than one foot thick of brickwork as a lining over the arches of ovens, but it is thought better, in the more recently constructed works, to have at least two feet of brickwork over arches, as it helps to retain some of the heat that might otherwise be wasted.

Tie-Rods.—The plan adopted in many gas-works, of putting tie-rods of binders through the brickwork near the arches of the ovens, is, in my opinion, not a good one, as they cannot avoid getting nearly, if not quite, red hot, in which state they possess little strength, and consequently cannot be relied upon for holding the bench together while it is working. I consider it better to pass the tie-rods over the top of the bench, thereby removing them as far as practicable from the heat.

Ascension Pipes.—These are now usually made larger than formerly, with a view to prevent choking, but I think we have arrived at the conclusion that regular charging and regular heats will be found the best remedy for this.

Hydraulic Mains.—The dimensions of these in small works is not of so much importance, but when a large number of retorts are employed it is a matter requiring consideration. In Scotland the large demand for gas is confined to about four months in the year, at which time a great number of retorts may be working, while at other times very few. Now, seeing that the capacity of the hydraulic main must be such as to be equal to the area of all the dip-pipes on the hydraulic multiplied by a height of a column of water equal to the maximum pressure likely to be brought upon the hydraulic should the exhauster be out of action—which at least should be equal to the dip of the seal-cup of the purifiers, seeing that wash-vessels are seldom employed now—it follows that, to avoid having a very large seal on the dip-pipes, the hydraulic should be made wide. It is usual, therefore, now to make the hydraulic wide, and comparatively shallow; but to avoid having it too wide, it is advisable to have the main in short lengths, say a length for every four or five ovens, there being less dip-pipes in each length, the gas being taken away from the lengths in use by a back main, which enables all the lengths not in use to be shut off, preventing the chance of drawing air, or the tar being syphoned over into the retort-house.

This tar is usually taken off by a separate pipe from the gas-main, and upon it is placed an arrangement for adjusting the dip. By doing so, the risk of the tar and heavier oils absorbing the richer naphtha from the gas is reduced; and, as Mr. Young has shown, the loss arising from the absorption is greater than any gain to be got in saving of purification, by the tar, &c., taking up sulphur compounds, as is the intention when tar, &c., are allowed to flow away by the same main as the gas.

As regards the position of the hydraulic main there are diversities of opinion. Some place it along the retort-house wall, necessitating the ascension-pipes being carried across the retort-house from the bench, which, in addition to the increased cost for the ascension-pipes, they have a greater tendency to choke up. These pipes must also at the same time be greatly in the way, and would, where many retorts are employed, be a great inconvenience, without any particular advantage. Others, again, would have it to rest on columns in front of the retort-bench; but these columns prove to be a great inconvenience to the working of the ovens. Neither do I think it is a good plan to make the bench-binders carry the main, as these must come and go, to a certain extent, with the expansion and contraction of the bench, and so have a tendency to rack the joints of the ascension and dip pipes, and thus cause them to leak. I consider, therefore, as the plan possessing the least evil, although not free from objection, that the best way is to support the main off the retort-bench. In that position it is still liable to be disturbed by the coming and going of the bench, and requires to be frequently examined, so as to keep it level throughout its length, to avoid joints being broken; but I think there are fewer evils and inconveniences attending this arrangement than any of the others. It also has the further advantage of being kept warm by waste heat from the bench, and so prevents the tar from taking up or retaining so much of the naphtha as is the case when the gas is subject to a very cooling action in the hydraulic main.

In the usual practice the gas-main from the hydraulic to the condensers is made to act as part of the condensers, and is often made of unnecessary length for this purpose; but it is a very questionable practice, as it keeps the tar and gas too much in contact, which, as you have frequently experienced, has a very deteriorating effect on the illuminating power of the gas. It is evident, therefore, that the distance between the hydraulic main and the condensers should be as short as possible.

Condensers.—In the condensers we have again great diversity of opinion as to their proper form and arrangement. I need not detail to you the various forms and descriptions in vogue; they seem to vary something like the fashions. In old times the "Battery" condenser was the one chiefly in use, then the upright pipes, and now what is most generally adopted is the annular form of condensers. They give a large cooling surface, occupying a comparatively small yard space, and, no doubt, they are very efficient for the purpose of cooling the gas; so much so that there is considerable risk of their choking, and there is sometimes a difficulty of keeping them tight at the joints at top and bottom lengths. They have a much more massive look than the pipe, or battery condensers; but, after having had experience of the different forms, I am of opinion, when each form has been duly arranged as to capacity, and in proportion to the work to be done, that there is little difference on the score of efficiency. First cost is another guiding element in the selection of form, but I do not think much difference will be found in this respect either.

The question as to the proper method of condensation, and the extent to which it should properly be carried, is one which, at the present time, is receiving a good deal of attention, and I have no doubt, as first-class cannels become dearer, that it will receive even more attention.

It is now being properly recognized that the process of condensation is one of the most important steps in the manufacture of gas. In the process of cooling the gas there are certain heavy sooty matters which, by their specific gravities, settle down, and which the gas cannot carry forward for any great distance; and, again, there is water that requires to be removed, and the removal of which can only be effected by cooling; but at the same time there are other important constituents of the gas as it comes from the retorts, which must, by all means, be retained in the gas to keep up its illuminating power, and, in carrying out the process of condensing, the object is to try to obtain these various results in a judicious and intelligent manner. It is quite possible to so conduct the process as to seriously injure the illuminating power.

We have had shown to us on former occasions, and we know from our own experience, that the gas as it comes from the retorts is not all permanent gas, but consists of considerable quantities of light-giving constituents in the form of vapours, which are removed in the process of condensation or cooling, for the simple reason that when the temperature of the gas is lowered, its carrying power, or its capacity for holding these vapours in suspension, is proportionately reduced. It is evident, therefore, that when the gas is cooled rapidly or suddenly to the same temperature as the atmosphere there must also be carried down or dropped out of the gas a larger proportion of its light-giving vapours, and, at the same time, it appears to me that the heavy tarry or sooty matters which are settled out by their own weight, not having time to entirely settle down, are carried forward to the purifiers to the injury of the lime.

It is, therefore, necessary that the gas be cooled slowly; that is to say, the usual arrangement of condensers, in which the lower portion is formed into a tar-box, the gas being made to pass, every time of its descent, over the tar and oil in the box, is not a good arrangement, although a common one. As you are aware, the usual practice is to distil the tar produced so as to recover the naphtha taken up by the tar, which, by this second treatment, is driven over as vapour from the tar and condensed to a liquid for sale, thus involving a double expense—first, for rich cannel to make up for the loss of illuminating constituents in the condenser; and, secondly, to recover them again; and it is to avoid this expense that Messrs. Aitken and Young have introduced their "Analyzer" condenser, the double process, as you know, being carried on in the one vessel, the naphtha removed from the tar being carried forward with the gas as a permanent vapour, thus enriching the gas, and rendering it necessary to use only a very small proportion of rich coals, if any, to keep up the quality.

Exhausters.—It is now generally acknowledged that an exhauster or pump to draw off the gas as produced is an advantage, although as to what is the actual amount of gain to be derived from its adoption there is considerable difference of opinion.

There are two kinds of exhausters generally in use at the present time—the "Rotatory" and the "Reciprocating," both of which are very efficient machines. There is also a third kind—Messrs. Cleland and Körting's—by which the gas is exhausted by the direct action of steam on the gas, and its power as an exhauster is undoubted; but of its advantages or disadvantages over the usual pumps I am unable to speak from experience; but to-day we have had Mr. Jeffery's experience of these matters laid before us.

Of the two first-named kinds of exhausters I prefer the "Reciprocating." This one, as you are aware, is arranged like an ordinary steam-engine, and the pumping and steam cylinders being on the one bed-plate makes it a very compact machine; and I am inclined to think there is less wear and tear in this machine, as it runs at less speed than the rotatory kind, with which also there is usually a great deal of gearing.

In connection with the exhauster, Messrs. Laidlaw and Son have introduced the bye-pass compensater, a very valuable addition to the machinery of a gas-works. By this instrument the vacuum on the retorts is not only kept, with the most unerring precision, at that required, however fast the exhauster may run away—a very important matter in moderate-sized works, where the engineman has other duties to perform, and the exhauster has to be left without attention for a time—but in the case of the exhauster suddenly stopping, it instantly acts as an efficient bye-pass, without risk of sticking, as in the case of the ordinary flap-valve bye-pass. I may here add that it is a matter of remark, and one that Mr. Young has lately called attention to, that in shale oil-works an exhauster should be employed to prevent the formation of gas, and in a gas-works to increase the quantity of gas made; but a little consideration will show that both plans are perfectly rational. It is remembered that one is working at a low temperature and the other at a high one. The object of the oil maker being to produce oil, he draws off the vapours as produced in the retorts, to prevent, by their retention there, their being overheated and converted into gas; but in the case of the gas maker, working at a high temperature, his object is not only to get, if possible, more gas by removing the pressure from the retorts, but also to prevent the gas, by its retention in the retorts, being broken up into its constituents of carbon and hydrogen—or, in other words, to prevent deposition, on the one hand, of carbon in the retorts, and, on the other, the production of gas of a non-illuminating character.

That there is an increased production of gas by the use of the exhauster is undoubted, but I do not think it should be credited with the increase in make some people would give it. To work with an exhauster for months, and then suddenly throw it off, will no doubt give as a result a considerable

leakage of gas from the retorts; but it is equally undoubted that if the retorts are allowed to work without an exhauster for a few days they will close up, and there will be little or no leakage unless the retorts are in a defective state.

Scrubbers.—I suppose the old wash-vessel is now hardly in use anywhere. The pressure it caused to get the gas through the water, as compared with the scrubber, which throws no pressure, as well as the larger quantity of ammoniacal liquor the scrubber produces in consequence of its more efficient action, has everywhere secured its adoption. The shape or build of the scrubber is generally much the same; the great point and aim being to spread or separate the water, so that none of the gas will be able to pass through the scrubber without being brought into contact with the water.

Usually the gas is admitted at the lower end of the scrubber, and takes an upward course, meeting the water as it falls from the top; but sometimes, by having a division in the scrubber, the gas after reaching the top is made to take a downward return course.

To thoroughly spread the water in the scrubber, a variety of plans have been adopted, such as having a series of sieves carrying coke, bricks, or birch-broom, and frequently the scrubber is filled with boards; in all cases the object being the same, to expose a large surface of water to the action of the gas.

The method of supplying the water is usually twofold—it is either allowed to flow in a continuous stream, the sieves upon which the water-spreading material rest being made to revolve by machinery, to ensure that the material is all equally wetted; or the lower part of the scrubber is formed into a tank, and the water pumped over and over again until it reaches the strength required.

When the process of having a constant stream of water is employed, the scrubbers are made of great height, to enable or allow of the gas being in contact with the water for a considerable time, to make certain that the whole of the ammonia is removed from the gas; but when the plan of pumping the water repeatedly is adopted, then scrubbers of much less height will do. I am inclined to think the latter plan is the better one, as it enables the water to be brought up to any strength required. Of course, in the first-mentioned system, the water could be used over again by pumping it up to a cistern over the scrubbers, and that would involve pumping, in addition to the cost of working the revolving machinery, as the water would require to be lifted to a much greater height than in the second system, where pumping alone is required; but in the second plan it is advisable to have two scrubbers in order to get all the ammonia out of the gas. Whichever plan, however, is used, the water should not be allowed to get up to a greater strength than 6° or 7° on Twaddel's hydrometer; for when it reaches this the ammonia leaves the water, passes off with the gas, and as this cannot well be avoided under the process of the water constantly flowing, it is an additional reason for preferring the repumping plan with two scrubbers, because in the first scrubber the water may be brought up to proof 10° or 12° on Twaddel before running off, and in the second scrubber the water can be run off at proof 5°. In my own works I use three scrubbers—first, to provide against the possibility of any one of them getting out of order through either of the pumps ceasing to work, &c., and to serve as a check in case of the others not proving sufficient, from any cause, to remove the whole of the ammonia. By this means I seldom find more than the very faintest trace of ammonia at the outlet of the third scrubber, as a rule, or practically none; and as evidence that the whole of this part of the purification is done by the two scrubbers, I have frequently the third one working for days without gaining a single degree in strength. Usually it only does gain anything when the second scrubber is allowed to get over proof 5°, which is sometimes done when the water in the well is weak, and I am desirous of getting up in strength.

There should be, of course, a separate pump to each scrubber. I find the double-acting kind with iron valves, having the air vessel on the delivery side, as efficient and pleasant working as any. It is sometimes the practice to drive the pumps by the same engine as drives the exhauster, but as these have frequently to be driven at different speeds, it is more advisable to have a separate engine for pumps alone.

The scrubbers should be tested daily, the gas for ammonia, and the water for strength, to ensure efficient working with the best results; and fresh water used in scrubbers, I find, gives the best results as to the *quantity* of gas liquor, but to get up the strength it is sometimes necessary to fill the scrubbers from the liquor in the well, which necessitates a separate pump being used for this purpose.

Purifiers.—There is little difference in the arrangement of these from what has existed since the general adoption of the dry lime process, with the exception that they are now made much larger in proportion to the gas made than formerly. One or 1½ square feet of floor surface of purifiers per 1000 cubic feet of daily make is now considered too small, and many of the more experienced gas makers are recommending from 4 to 5 square feet per 1000. This is larger than circumstances will admit of in most works, but there is no doubt that to thoroughly utilize the lime, and to reduce the per centage of waste, the area of the purifiers should be made as large as possible, and it is advisable that the gas should be made to pass through a series of three or more purifiers. To pass the gas simply through one, or any one of a set of purifiers, is now recognized to be both inconvenient and wasteful of lime.

Partly from the want of suitable arrangement, and also from the difficulty of getting rid of the spent material, oxide of iron is seldom used in Scotland. I find, however, considerable economy in its use; but it cannot be used alone, as, from the large per centage of carbonic acid in our crude gas, and the serious effect it has upon the illuminating power, lime must always be used with us to remove this impurity.

One per cent. of carbonic acid in the gas destroys its illuminating power to the extent of 5 per cent., or with 30-candle gas destroys the light to the extent of 1½ to 2 candles; but with 14 or 16-candle gas, as in England, where oxide is almost entirely used, the effect is not so serious, and the cost for rich cannel to make it up is not so great, and, consequently, oxide may be used there alone.

I am glad to have the opportunity of calling your attention to an invention of Mr. G. R. Hislop, of Paisley, which, by a process of revivifying, a very great saving will be effected in the first cost of lime. Although not yet generally brought before the public, the invention has been patented. Mr. Hislop has not yet completed his experiments, and, until he does so, is holding the matter back, but I do not think I am doing wrong in giving you a general idea of the process, leaving him at a future day to give you a more detailed account.

The process of revivifying consists simply in a recalcining of the spent lime. The spent lime is placed in a series of chambers built in an oven, and almost similar to ordinary retorts of about the same size. The flame, however, instead of being made to play round the outside, as in the case of gas-retorts, is made to pass through the chambers, and over the lime from one chamber to another, the spent lime being charged into a chamber, and spread over the bottom of it, the same as coal, and by this means the whole of the carbonic acid in the lime is driven off, and the lime restored to its original state, as when first put into the purifiers, for which it is again ready after being cooled and slaked. The whole process is an exceedingly successful one, and will be a great boon to gas makers. It can readily be adopted on works of any size. I am so satisfied with it myself, that it is about being adopted in the Greenock works.

Gasholders.—It would take up too much time to go into descriptions of the various improvements now adopted in the construction of these; but I may say that the larger sizes are now generally made telescopic. The feeling against this method has in Scotland now, I suppose, quite died out. And it is also generally recognized that the capacity of holders, in proportion to the maximum make, should be much larger than has hitherto prevailed. From the long continued dark weather that sometimes prevails, our holders should be much larger in proportion to our maximum make than there is a necessity for in the towns of England; but, notwithstanding, you usually find the capacity of holders, in proportion to make, much larger there than with us. But I think an error is committed when the holders are less than equal in capacity to one day's maximum consumption. There cannot be a doubt that ample gasholder capacity is not only a matter of great safety and comfort, but a great item in economy of manufacture; it effects a saving both in coals and in retorts.

There are two or three matters of minor importance in connection with gasholders that I should like to call attention to. The first of these is sightliness. In England they are far before us in this respect, when one sees the handsome and elegant arrangement of columns and girders frequently employed there, and compares them with the usual post and rails pattern often put up in Scotland, not to the credit of the owners of gas-works in this country.

Secondly, with regard to the painting, I think holders should be always painted, and not coated with tar. Although, not without blame myself in this respect, I do not think that tar either preserves the iron or keeps the holders so tight as paint; and I may add, for the information of some, that it is quite unnecessary and useless to paint the insides of gasholders, as the gas not only prevents any corrosive or oxidizing action going on inside the holder, but destroys the paint, especially if it is made up with lead. It is quite sufficient that the plates be coated with oil inside.

Thirdly, the main connecting the various holders together (for there should never be less than two or three on a works, in case of accidents to gas or gasholders) should be above ground, not only to facilitate getting at valves, but to prevent yard mains getting flooded with water should pipes inside tanks give way or start leaking.

Tanks.—With regard to the construction of gas-tanks, there is so much depends upon local circumstances, such as nature of the ground, materials that can be most readily got, and other contingent circumstances, that no rule can be laid down, and one is compelled to do as dictated by local circumstances.

Governors.—It is quite unnecessary to describe the various forms of these, as you have so lately had several new arrangements shown at these meetings; but it is generally considered that, as a matter of precaution, the holder of governors should be entirely closed in.

There are two modes of balancing the holders, either by an air chamber inside round the bottom end, and allowing them to float directly upon the water in the tank, or by back balance-weights passing over a wheel or lever. I am inclined to think the former plan the better one, and prefer the cone to the throttle-valve arrangement, the water being affected by the slightest variation in the pressure up or down, the holder instantly following suit, carrying the cone with it, whereas the throttle-valve is likely to stick; at any rate, I do not think the pressure can be adjusted so delicately with the valve as with the cone.

With respect to the holders with back balance-weights over a wheel or lever, I find there is a difficulty in either getting them sufficiently sensitive to the variation in pressure, or when once set moving are likely to remain unsteady for a time. Although this point has received great attention from makers, still I am inclined to prefer the holders without them. The difficulty of adjusting the pressure when the holder is entirely closed in, either with or without back balance-weights, has prevented this method being adopted so often as it would have been; but the clever arrangement of Mr. Key, where back balance-weights are used, or the very ingenious invention of Mr. Peebles, who employs the gas itself to adjust the pressure, now enables the gas-governor to be entirely closed in. By the latter method it is quite impossible that the gas can escape, or the holder receive injury.

I would close these remarks by drawing attention to a few points respecting distribution.

This is a subject that receives a good deal of attention, but often not quite in the right direction. It usually happens that one district requires a great deal more gas than another, and to supply it an increased pressure is put on, causing the pressure in other districts to be excessive, incurring a great waste of gas to the consumers and the works.

It is self-evidently unfair that one district should have either a greater supply or pressure than others. To avoid this, in cases where works are situated at one end of a town, an initial main should be carried to the centre of the town, and branch mains taken to the respective districts, of a size proportionate to the quantity of gas required, and where this cannot be accurately adjusted, district governors or valves should be placed upon the mains, and the supply and pressure adjusted accordingly; but when valves are used, it is to be borne in mind that these are only effective while there is a demand for the gas. When that ceases the pressure on both sides of the valves becomes very much alike.

When the works are situated in the centre of a town, separate mains should be taken directly from the works, with a governor upon each. It is also absolutely necessary that the street pressures be taken regularly all over the town two or three times a year—say just before and after the season of maximum consumption—and the governors or valves adjusted as circumstances may prove necessary.

In finishing this very long story, it has, of course, to most of you, been like singing an old song; but I hope, in endeavouring to comply with the request of the committee, that I have called attention to, or suggested a few ideas that may prove useful to some.

Mr. Niven (Dunoon): We must be deeply indebted to Mr. Stewart, who is one of our most eminent gas engineers, for the able paper which he has just read. There are two points in his address on which I should like to say a few words. And the first is in regard to the duration of the charges. The usual time is about four hours; but I understand that the practice in Greenock is to have three-hour charges. I find that most coal is distilled in three hours, but I look upon the fourth hour as a reservoir of heat, to be expended on the new charge. The only reason why I have been carrying out four-hour charges is not that there would be any increase in the illuminants, but rather that there should be a reservoir of heat for the new charge. The other point is in regard to the lime. I have a great quantity of lime of which I cannot get rid; and I am, therefore, glad that Mr. Hislop has taken up the subject of the revivification of the lime. As Mr. Stewart states that lime can be revivified at a cost of 8s. per ton, and as most of the managers here will pay about 20s. or more for the ton of lime, I think the question is of such importance that a committee ought to be appointed by the Association, to deal with the question in a way similar to the way in which the Aitken and Young process was considered.

Mr. Young: I have very little to say in addition to what has been so well said by Mr. Stewart on the subject of the construction of gas-works.

I am quite at one with him, with the exception of what he said as to exhaustion. As is, perhaps, well known to the members of the Association here, I hold views different from those generally entertained on this subject. Indeed, I am not a believer in all the benefits said to be derived from that process, and I am very glad to get a gentleman like Mr. Stewart to express his opinion on this subject, as it may be the means of eliciting an interesting discussion. In a paper which I read some time ago before the North British Association of Gas Managers, I drew attention to the fact that we are very imitative—that we adopt systems because others adopt them; and I stated that it was my opinion that, in many cases, exhausters had been adopted, believing in a gain which was not; that my reason for expressing such an opinion was the fact that exhausters were used in order to produce different results in substantially the same process, as in oil-works we use them for the purpose of lessening the quantity of gas, and increasing the yield of liquid hydrocarbonaceous products, while, on the other hand, in gas-works we use exhausters to produce the very opposite results—namely, to increase the yield of gas and lower the oil or the tarry products; and that, in my opinion, these results were not in harmony with each other. Mr. Stewart has made the explanation that we work at a low temperature in the one case, and at a high temperature in the other; that the object of the oil distiller being to produce oil, he exhausts the vapours to prevent their decomposition; and that the gas manufacturer employs the exhauster to prevent over-decomposition of the gaseous products into their elements of hydrogen and carbon. However, Mr. Stewart's logic in regard to the difference of temperatures does not, in my opinion, hold good. The oil distiller uses the lowest heat possible to carbonize his shale. He would use a lower if he could, but he cannot. He does so to prevent the formation of gaseous compounds, and exhausts the products with the same object; but the gas producer uses the highest heats he can conveniently get to carbonize his coal, with the view of decomposing the products of the coal to produce gas. Therefore, in my opinion, it appears paradoxical to employ exhausters to draw off the products of distillation, and prevent that which the high heat is employed to bring about. This is well illustrated in the case of Mr. Malam, who employed highly heated incandescent coke through which to pass the products of distillation, to gassify them, and yet he employs an exhauster to draw off the gases and prevent that which he intends to produce by the use of this very incandescent coke. I am at one with Mr. Stewart in believing that where the gas is over-decomposed it is an advantage to employ an exhauster, but where the decomposition is not sufficient I think it is equally evident that the exhauster will be a disadvantage. We have a friend here amongst us to-day—one of the members of the Waverley Association—who has been for some thirty years a reader of the JOURNAL OF GAS LIGHTING, and who expressed ideas to me similar to those I am laying before you to-day. He stated to me that he had found these ideas in the columns of that JOURNAL, and that they were the expressions of the great Faraday—namely, that in the process of the distillation of cannels the gases, as a rule, were under-decomposed, and that it would be an advantage to retain the gases for as long a time as possible in contact with the heated retort during the process of destructive distillation. I am not at one even yet in believing that all the advantages claimed for the exhauster are what they are said to be—that is, that the illuminating power and the volume are both increased at the same time. I believe that it is impossible to do both with our present carbonizing arrangements. If we produce over-decomposition of the elements of coal, we can only do so by lowering the illuminating power of the gas. On the other hand, when we produce under-decomposition, we do so by lowering the volume, but also at the same time increasing the illuminating power. In fact, so far as our experience has gone in the manufacture of gas, it is impossible to produce an increase in the volume without also producing a decrease in the illuminating power—that is, so far as the mere carbonizing of the coal is concerned. I am not referring to the after treatment, and during condensation and purification. While I am ready to admit that the exhausters increase the quantity of gas by preventing leakage through the walls of the retorts, &c., I am inclined to deny, until we get further information, that it will increase the quantity of gas and the illuminating power at the same time. There is not the least doubt that there is a considerable amount of leakage through the walls of the retort, and the employment of exhausters in this respect, by preventing leakage, is very useful, as well as in distending the gas during the process of condensation; but that it should, by some mysterious and unexplained method, increase the illuminating power and the volume simultaneously I cannot understand, and hitherto I have been unable to get an explanation as to how that can be accomplished. There is another point on which I have to express an opinion, and of which our President now remainds me—namely, the advantage and economy of using tar as a preservative of ironwork, more especially gas-holders. In fact, I hold an opinion that, so far as mere protection of the ironwork is concerned, independent of its look, I think it is very much superior to ordinary paint. Paints, as a rule, are composed of pigments blended with oils, and in many cases these pigments have a strong affinity for the sulphur compounds floating through the air, and these sulphur compounds, undergoing further oxidation, tend in turn to produce oxidation of the iron over which they are spread. When I speak of tar painting, I do not speak of it in the way in which it is most commonly applied—namely, not to paint, but rather to plaster it on the holder. That I do not consider to be protecting the holder. Tar ought to be taken and washed free from ammonia salts, &c., and then thinned down with some volatile solvent until it becomes as thin as, or rather thinner than, ordinary paint, and a film should be spread over the ironwork which it is intended to protect. I have no doubt many of you will have experienced considerable difficulty in getting a gasholder which has once become rusted properly protected. You may scrape it, and paint it to the best of your ability, but somehow or other, the moment it goes under the water, the iron appears to undergo further oxidation, and the paint peels off in layers. I experienced such a difficulty in painting some of the tanks in my works. These tanks, during the process of erection, were exposed for some time to the weather in an unpainted state, and they got very badly rusted. From past experience, we knew that paint would be of little or no use. However, I tried the experiment of painting them, after being well scraped, with a solution of caustic lime and caustic soda, which, after being thoroughly dried and brushed off, so far as possible, was covered with a thin film of tar, and from that day to this they have not shown the slightest indication of rusting. I believe that this will be found a valuable application to gas-holders, especially where rust has, so to speak, got the upper hand. I believe paint would act in a similar way when laid over iron which has been prepared by the soda-lime solution, though I do not think it would protect iron as well as tar. Most of the roofs at our works are formed of corrugated iron. At first these were painted with ordinary paint, but we found that they were being rapidly destroyed. Perhaps this may be on account of the coals and shales used at our works being very sulphurous. Indeed, every 24 hours, there are vomited forth into the air upwards of four tons of sulphur. When we found the roofs giving way, I subjected them to treatment similar to that which I have described for the tanks, covering them with two coats of tar. Recently I examined them, and found that wherever the tar had been applied, it had thoroughly resisted and prevented the action of the sulphurous gases from the works. Indeed, in my experience, I have found nothing that protects ironwork so well as tar.

Mr. CLAZY (Kelso): I have a gasholder which has been painted all along, and it is as good as the day it was made, and that is 40 years ago.

Mr. YOUNG: I have no doubt if a holder is painted at the beginning, and carefully attended to, the paint will protect the iron perfectly.

Mr. ROBSON (Selkirk): I think the best exhauster we can have is a good heat and a large-sized pipe. At our works the first apparatus, after leaving the hydraulic main, is an expansion chest, and I consider that of more benefit than any exhauster. The moment the gas gets there it expands and parts with all the heavy tars. Since we put up that chest we use less lime than we did ten years ago, although we have trebled the make of gas. We get our lime for nothing, because I can sell it to the farmers at 7s. 6d. per ton. Originally it costs 14s. 9d., and when it leaves us it is nearly double its original weight, so that the lime does not cost the company much. If Mr. Niven sent his lime south, he would find a ready market for it.

Mr. M'LEOD made some remarks upon the external amenities of works, and pointed out how much order and system added to the beauty of gas-works.

Mr. STEWART: In respect to the three-hour charges, my experience is this time is enough for most of the coals that we have in Scotland. No doubt there is a certain cooling of the retort after the charge is put in, but by the end of the first hour the heats have recovered themselves. Of course with some coals four hours are requisite; I refer to the ordinary modes of working excessive heats or extra large charges, would necessitate a different course from what I have suggested. As you are aware, I believe only in a fair average heat. I do not believe in the extra heats that some indulge in, for I think that they do a great deal of harm. With ordinary heats we can work off the charge from most of the cannel coals in three hours. But, as I said before, it does not do to lay down a hard and fast line for the duration of the charges. With regard to Mr. Young's remarks on the exhauster, there cannot, I think, on the part of those who employ it, be but one opinion, that it is a most valuable instrument to the gas manufacturer, apart from any theoretical opinions as to its effects on the quantity or quality of the gas. We all know that there are certain conditions of the retorts during the time they are in action, such as after cleaning or repairs, or after standing idle for a few hours, when it is absolutely necessary that the pressure upon the retorts be kept as low as possible, to allow of the retorts tightening up, otherwise the loss of gas would be very serious; and this can only be done by the use of an exhauster. It gives also considerable ease to the men in closing the retorts after charging, and does away also with the annoyance arising from any excess of pressure from partial stoppage or block in any part of the apparatus. I agree with Mr. Young, that one cannot get an increased yield per ton of coal, and, at the same time, an increase in the quality of the gas. But at certain stages of the distillation of the coal, by the exhauster relieving the retort, the gas will be assisted in coming off, and so tend to increase the yield, and, at another, when the charge is nearly worked off, by removing the gas, prevent its decomposition in the highly heated retort, and so keep up its quality, and avoid the accumulation of carbon in the retort. I spoke of tar as it is usually employed at gas-works, which is simply in the condition of ordinary boiled tars, and then it is not as good as paint; it melts with the sun, and the chances are that the joints are not kept so tight as with paint. As to the expansion-chest, it is an extension of the condenser, and good condensation has an effect on the purification.

The PRESIDENT: I do not think Mr. Hislop's invention is as yet ripe for investigation, as suggested by Mr. Niven. However, the suggestion is a good one, and should not be lost sight of. In regard to the waste lime, I think Mr. Robson was raising a stick to break his own back. I have a great deal of lime that I have some difficulty in disposing of, and if we send that to the south we may soon reduce Mr. Robson's prices. There can be no doubt that a painted holder has a better appearance than one which has been tarred; but on the question of durability, I may state that last summer I saw a holder at Worcester which had been tarred for 40 years, and it was as good as the day it had been made.

On the motion of the PRESIDENT, a hearty vote of thanks was accorded to Mr. Stewart.

(To be continued.)

LIGHTING BY ELECTRICITY.

COMPARISON OF ELECTRIC LIGHTING WITH GAS LIGHTING.

Extract from a Paper by M. Malézieux in the *Annales des Ponts et Chaussées.*

[Translated from the *Journal des Usines à Gaz.*]

Nothing is more natural than to take gas lighting as a term of comparison, if we wish to estimate the commercial value of the electric light; but we must not confine ourselves simply to comparing the items of expenditure. We must first of all inquire how far, and under what conditions, the new mode of lighting could replace the old. We will not touch upon the financial part of the question until we have looked at it from a technical point of view.

I.—TECHNICAL COMPARISON.

If it were necessary to lay down dogmatically the principles of a good system of lighting, we could refer to one of the most undoubted masters of modern science; we could quote two papers presented by Lavoisier a century ago to the Academy of Sciences, one "On the Different Means that may be Employed to Light a Large Town," and the other "On the Manner of Lighting Theatres." We shall, however, now content ourselves with at once entering upon an examination of the special question that engages our attention.

At first sight there are two features characteristic of electric lighting—the great brilliancy of the light, and consequently the nature of the shadows thrown. The direct rays are unbearable to the sight, and the shadows are so singularly deep that workmen employed in the dockyards have often mistaken them for holes that seemed to have suddenly opened at their side; and according to experiments made at various times in the public thoroughfares of Paris, horses are scared by the light.

The excessive brilliancy of the electric light is easily remedied. This may be done either by causing the rays to pass through ground glass, or by dispensing with the shades ordinarily used, and profiting but little from the rays of light directed upwards. The end is, therefore, attained, but at the sacrifice of at least one-fifth of the light emitted. An electric lamp equal to 100 Carcel burners is thus reduced to, at most, 80 burners of utilizable light.

As far as the shadows are concerned, there is a very simple process for softening them as completely as may be desired. It consists in multiplying the luminous points in such a way as to illuminate on all sides any object it may be desired to render clearly visible. But in the present condition of the means for producing the electric light, it does not readily adapt itself to such a division. In reality it cannot be subdivided below 100 burners, which, for the present, must remain the real unit of the light. The number of lights is, therefore, naturally restricted; no more than four have yet been employed for lighting the same area. The usual method employed for softening the shadows being applicable only to a very inadequate extent, another plan has been tried in the elevation of the lights above the ground. In the workshops of MM. Sautter-Lemonnier they

are placed at a height of more than 6 mètres (about 20 feet); at the Northern Railway Terminus they were 9 or 10 mètres (30 or 35 feet) above the ground, and 14 mètres (46 feet) at the terminus of the Eastern Railway. The light coming downwards does not make the shadows less deep, but they are not so elongated.

Here, therefore, we have the second disadvantage, if not removed, at least mitigated; but at what cost? Have we got rid of it only at the inconvenience of being compelled to use steps or ladders when we wish to get up to the lights? We are about to show that this unusual elevation of the lighting apparatus, combined with their great horizontal interval, causes a second and considerable diminution in luminous intensity.

It is important that there should be a thorough understanding upon certain words and things, and to this end we shall make a few preliminary observations. The intensity of a light, as estimated and figured by the aid of a photometer, is not the sum of the light emitted—the total number of rays, which, diffusing themselves in proportion to their distance from the focus, illuminate in the same degree all parts of each spheric enclosure of which this focus would occupy the centre. The intensity of a luminous focus is altogether another thing; it is the quantity of light that would be received by the unit of surface placed at the unit of distance—the Carcel lamp being taken as unity. On the other hand, the degree of lighting at a given point of space has for expression the quantity of light received there by the unit of surface—a square décimètre (one square foot) for example. This quantity varies, in so far as it issues from a given luminous focus, in inverse ratio to the square of the distance traversed by the light. Consequently, in order that the light may be the same when there are two luminous focuses, the intensities, N and n, of these focuses must, between them, be as the squares of the distances, D and d. In a word, we have the proportion—

$$N : n :: D_2 : d_2.$$

In order to fix this upon the mind, let us make N = 80 Carcel burners. At what distance would a lamp give as much light as a Carcel burner placed at the distance of 1 mètre? If we make $n = 1$ and $d = 1$, we get—

$$D = \sqrt{80} = 9 \text{ m.}$$

What would this field of illumination become if we were satisfied with a less powerful light, such as that given by a Carcal burner placed at a distance of 5 mètres (16 feet)? If we make $n = 1$ and $d = 5$, we get—

$$D = d\sqrt{N} = 45 \text{ m.}$$

If the distance is diminished by one-half, in what proportion could the intrinsic value of the luminous focus be reduced without altering its relative intensity? Making $d = \frac{D}{2}$, we obtain—

$$n = N\frac{d_2}{D_2} = \frac{1}{4} N.$$

Therefore a lamp of 20 jets would, according to this hypothesis, be equal to one of 80 which was twice as far removed from the objects to be lighted.

This being understood, how does a superintendent of works, who wishes to understand clearly what he is doing, lay down in practice a lighting problem? Does he ask himself *à priori* what is the total amount of light to be produced for the illumination of a given area, and whether this light requires the equivalent of 200, 300, or 400 Carcel burners? Nothing is farther from his thoughts. He has in view a certain number of men who are to work in this area, and perform therein operations requiring a varied amount of attention. We may suppose that these men are grouped, standing or sitting, round circular tables, lighted by a central lamp. By varying the diameter of the tables, each workman is ensured the necessary degree of light. If certain points are over-lighted, the superabundant rays will be regarded as lost, for we exclude the hypothesis of intentional extravagance in lighting; or, more strictly, these supplementary rays which would be projected upon certain spots (as happens with the electric light), interfering as they do with the view of objects less brilliantly lighted, would be of a nature to fatigue the sight. But let us not insist upon this special disadvantage of inequality in illumination. Let us confine ourselves to saying that the objects considered as *lighted* shall be those that receive, at least for the unit of surface, the quantity of light required and defined in the programme.

Susceptible of indefinite subdivision, gaslight, in adapting itself to the most complex requirements of workshops, enables these distances, which so seriously modify the useful intensity of luminous focuses, to be reduced to a minimum. The electric light, on the contrary, has its exigencies, to which industry must submit; you must take it or leave it. As these apparatus are not numerous, they are necessarily very far apart, and as they are at the same time elevated, they occupy positions relatively far removed from the objects to be lighted. Consequently, the number of rays thrown by them on to a given point on a superficial area of a décimètre is relatively restricted. Let us take an example. If the gas-lamps of Paris were placed at the height, not of the first floor, but of the fifth (at 55 feet instead of 12 feet), their relative intensity would be 25 times more feeble. What would then become of the lighting of the streets? Yet the quantity of light emitted would not have changed.

In conclusion, we shall have to ascertain what is, in fact, the average distance of the electric light from the objects to be lighted in the workshops or other places, or rather what relation does this distance bear to that which is usual in the case of lighting by gas. But an answer could scarcely be given to so general a question, and we shall confine ourselves to saying that the hypothesis already given, of simply double, appears to us to be rather under than over the reality—rather favourable than unfavourable to electric lighting, in the applications of it which have been carried into effect up to now.

To resume, then. Having regard to the partial absorption of the light by ground glass, and to the loss resulting from the remoteness of the lamps, we should be able, under ordinary circumstances, to light to the same degree—that is to say, to give to the unit of surface the same minimum quantity of light—by calling upon gas for one-fifth, or about 20 per cent., of the light produced by electricity; 20 gas-jets equal to as many Carcel burners would be equal in total utilizable intensity to 100 jets of electric light.

Of the various facts adduced and verified in the second section of the present paper,* we cannot see one that invalidates this estimate—a little hypothetical, probably—of the diminution in value of the electric light when it is applied to the ordinary purposes of lighting. Without having seen the foundry of MM. Hellmann-Ducommun at Mulhouse, we should be surprised if it could not be suitably lighted by 80 Bengel burners, each consuming 105 litres (3·7 cubic feet) of gas per hour. We also suppose that 60 gas-burners would suffice for the lighting of the workshops of MM. Sautter-Lemonnier. With regard to the luggage-room at the Northern Railway Station, we are not reduced to suppositions, and the example is significant enough for us to dwell upon it.

It is a fact that after having tried to light this hall with a single lamp of 150 jets, the authorities were forced to have recourse to two lamps of 100 jets each. If they had commenced with the electric light, and had kept to it, it would probably be alleged that, as lighting by gas would have required 200 burners, it would have been more costly than the other mode. But there is a second fact as patent as the first, and that is, that gas lighting has been in existence for many years, that it has performed its functions generally to the satisfaction alike of the Northern Railway Company and the public, and that they only employ 37 Carcel burners, divided among 28 special lighting apparatus. As this mode of lighting by gas affords such undoubted facilities for increasing or reducing the amount of light in exact proportion to the requirements of the service, it follows that the proportion of the electric light which, according to experiments made, was absorbed before arriving at its destination, or was lost in consequence of diffusion, over which we have no control, amounted to exactly four-fifths of the total light emitted by the two lamps. In other words, *each electric lamp replaced 20 gas-burners.*

This example appears to us very conclusive. It shows clearly that the error consists in comparing the cost of the two modes of lighting upon the hypothesis of the production of an equal quantity of light, by arbitrarily fixing this quantity at the figure casually corresponding to the total lighting power of the electric lamps, and in taking no account of the manner in which the light will be distributed, of the very unequal distance that will exist between the luminous focuses and the objects to be lighted, or, lastly, of the diminution in the amount of light caused by the ground glass.

Let us add a few more words with regard to the technical comparison. We will just call attention, but without dwelling upon it, to the fact that the electric light, even when softened, produces a strange effect upon the eyes—an uneasiness attributed by some to its bluish-grey (others say greenish) colour, and to its ultra-violet rays, which it contains in greater number than solar light. For the rest, this defect will perhaps some day be corrected by the interposition of suitably coloured globes.

It will probably be more difficult to deaden the rumbling sound which in all machines accompanies the production of electricity, and which, by partially drowning the human voice, may, under certain circumstances, cause some inconvenience.

There is one other disadvantage which has been admitted on all sides, and that is the irregularity of the light. This is attributed almost exclusively to a defect in the homogeneity of the carbons. If we have rightly understood M. Gramme, there might probably be another way of attaining this end, and that would be to spare no expense for motive power, but employ such machines as could with restricted rotative power, and without attaining the limit of their effective working force, supply the lamps with the required intensity. We may further ask whether the variations in this intensity would not depend, to a slight extent, upon variations in the speed of the fly-wheel, and these upon the oscillations which are, as is well known, inherent to the working of steam-engines. At all events, this dependence may, in the case of the Gramme machines, cause some fear to be entertained lest another inconvenience should present itself—viz., an abnormal development of heat, capable of destroying the isolating materials surrounding the copper wires. This is a point that does not appear to have yet been made absolutely clear.

The final fundamental condition of good lighting is the facility of installation, maintenance, and supervision of the apparatus, and the lighting and extinguishing of the lights. Now, the electric lamps, as we have said, are not generally accessible, except by the aid of stairs or ladders; and if, by the simple manipulation of a commutator, the current may be established or broken, the lighting (with the subsequent regulation of the disparity between the carbons, and the supervision of the imperfect regulators) is none the less an operation which can only be performed by a skilled workman. There is nothing of this sort with gas. It is well known with what facility it may be fixed to walls, or suspended from ceilings, how it is lighted and extinguished. There is, in short, between the two modes of lighting, so great a difference in manipulation—so much simplicity on the one hand, so much dependence on the other—that, were there no other advantage in favour of gas, the selection to be made could only in certain exceptional circumstances, as it appears to us, be subordinated to a comparison of the cost.

II.—Financial Comparison.

The production of light is one question; lighting is another. The means must not be confounded with the end. Thus M. Tresca, in his article of Jan. 31,* has by no means understood how to compare the cost of lighting. The honourable Academician has not even compared the cost of the combustible material. And further, his comparison was made for a Gramme machine of quite an exceptional intensity — one of 1850 jets, which furnished a determined quantity of light much more economically than the machines of 100 jets. As the cost of fuel, with both gas and electricity, is not proportionate to the cost of lighting, it follows that the comparison of figures in question—interesting enough from a theoretical point of view—did not implicate the practical conclusion which it was thought it furnished.

In taking M. Tresca's figures, therefore, we are about to complete the estimate of the cost per hour of lighting with both systems. We shall examine eight different cases, where the area has been lighted by one, two, three, or four electric lamps of 100 jets each, the Gramme machine being worked either by the engine of a large works, or by one specially fitted up for the purpose; although this fitting-up of a special engine has never as yet taken place, as far as we are aware, except in the case of lighthouses. In each of these eight cases we shall determine successively.—

1. Concerning the motive power employed—its value in horse power; the quantity and price of the coal consumed per hour; the cost of working the engine.
2. Concerning the electrical apparatus—the value of the carbon prisms consumed and the cost of supervision.
3. The amount to be reckoned per hour of lighting for interest and amortization of the expenses of first establishment.

Let us first of all indicate the bases of the estimate, in order that we may only have to group the calculated results in a tabular form.

Cost of the Electric Light.

Motive Power.—If we connect, in relation to the motive power, the results indicated by M. Tresca and those furnished for the terminus of the Northern Railway, we shall obtain the figures contained in the following table :—

Intensity of Light in Carcel Burners.	Number of Turns of the Central Coil per Minute.	Work Performed in Kilogrammètres per Second.		Force Expended in Horse Power.	
		Total Light.	Per 100 Burners.	Total Light.	Per 100 Burners.
1850	1274	576·12	31	7·68	0·415
300	872	210·65	70	2·81	0·937
150	800	187·50	125	2·30	1·670
100	800	180·00	180	2·40	2·400
50	1650	165·00	330	2·20	4·400

* The present extract forms Sec. 3 of M. Malézieux's paper.

* *Comptes Rendus de l'Académie des Sciences*, tome. lxxxii. No. 5, p. 299.

With the desire to interpret everything in the most favourable way for the electric light, we will suppose that a lamp of 100 jets requires, in normal working, a motive force equal to two horses only (instead of two, four). But we shall reckon one-half more, at all events for starting the engine, as the additional power then required might cause a momentary inconvenience if it were derived from an engine already fitted up—an ordinary engine, the surplus power of which is not always disposable. Besides, the current expenses are augmented only by a very insignificant amount that may be quite disregarded.

We suppose, with M. Tresca, that the consumption of coal per horse power per hour will be 4 kilogrammes (8·8 lbs.), at least for the small special engines; but we reduce it to 1·5 kilogramme (3·3 lbs.) for common engines, admitting that these latter are such as are now constructed, with all the latest improvements. The coal is estimated at the Paris price—30 francs (24s.) the ton.

For the power borrowed from the common engines, we place to the account of lighting, as expenses of first establishment, a proportionate amount, estimated at 1000 francs (£40) per horse power. With regard to the cost of driving the engine, we relieve the lighting account altogether of this charge.

For the fitting up of special engines of 3, 4, 6, and 8-horse power, we reckon, respectively, 1500, 1400, 1300, and 1200 francs (£60, £56, £52, and £48) per horse power. For working the engine and the trifling cost of maintenance, supervision, &c., we reckon 60 centimes (6d.) per hour.

Electric Apparatus.—For the polar carbons we reckon 1 fr. 75 c. 1s. 5·5d.), the actual price of the carbons, or 21 centimes per lamp per hour. (M. Tresca reckons 20 centimes.) Whatever may be the number of lamps, each supplied singly by a Gramme machine, we reckon 40 centimes as wages for the workman appointed to attend to them and to the induction machines.

Interest and Amortization of the Expenses of First Establishment.—Here we reckon an average annual charge of 10 per cent. applied to the cost of fitting up the engine, the Gramme machines, and Serrin regulators, spreading this charge (with regard to workshops) over an assumed period of 500 hours lighting per annum.

Cost of Lighting by Gas.

In conformity with what has just been said, we admit that gaslight equal to 20 Carcel burners must be furnished for each electric lamp of 100 jets. In face of a definite programme, and notably of a detailed plan of the area to be lighted, the number and shape of the burners to be employed for the combustion of the gas should be ascertained. Twenty Bengel burners, each consuming 105 litres per hour, might be adopted; but if it were not absolutely desired to have twenty luminous points independent one of the other, it would be preferable to employ burners consuming 150 or 200 litres (5·3 or 7 cubic feet). Provided that the burner was a suitable one, the illuminating power would increase more quickly than the consumption, and the cost of filling up would diminish with the number of burners. Nevertheless, to simplify the discussion, we will suppose that burners consuming 105 litres only of gas are used.

The price of gas is 30 centimes per cubic mètre (7s. per 1000 cubic feet) in Paris, as well as in Nantes, Toulouse, and Strasburg. In the United States, in 1870, it ranged nearly everywhere between 45 and 90 centimes, or 10s. 6d. and 21s. per 1000. Here, be it understood, it is a question of the price paid by private consumers to companies holding concessions, as in the large towns in France this price is reduced one-half for lighting the streets and public squares and buildings.

The cost of fitting up the gas in towns where the mains have been already laid, as well as for manufactories, may apparently be estimated at 30 francs (24s.) per burner. However, we reckon 40 francs, which is considered as the average charge for the houses in Paris; and although an annuity of 10 per cent. may here be excessive for interest and amortization, we shall reckon 4 francs per burner per annum, or 8-1000ths of a franc per hour of lighting. We reckon 1-1000th of a franc per burner per hour for maintenance, lighting, and extinguishing.

Under these conditions, lighting by gas costs 4 centimes (0·4d.) per burner per hour to private consumers, but if supplied to a municipality the cost would only be 2½ centimes (0·25d.).

The application of the foregoing bases leads to the results recorded in the two following tables :—

TABLE *showing the Cost per Hour of the Electric Light.*

	One Lamp of 100 Jets.		Two Lamps of 100 Jets.		Three Lamps of 100 Jets.		Four Lamps of 100 Jets.	
	Common Engine.	Special Engine.	Common Engine.	Special Engine.	Common Engine.	Special Engine.	Common Engine.	Special Engine.
Motive power required in normal working	2 h.p.	2 h.p.	4 h.p.	4 h.p.	6 h.p.	6 h.p.	8 h.p.	8 h.p.
Ditto for starting	3 ,,	3 ,,	6 ,,	6 ,,	9 ,,	9 ,,	12 ,,	12 ,,
Consumption of coal in normal working	6·6 lb.	17·6 lb.	13·2 lb.	35·2 lb.	19·8 lb.	52·8 lb.	26·4 lb.	70·4 lb.
Current Expenses per Hour.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Value of coal consumed	0 0·9	0 2·4	0 1·8	0 4·8	0 2·7	0 7·2	0 3·6	0 9·6
Charge of engine, including oil, rags, &c.	—	0 6·0	—	0 6·0	—	0 6·0	—	0 6·0
Cost of polar carbons	0 2·1	0 2·1	0 4·2	0 4·2	0 6·3	0 6·3	0 8·4	0 8·4
Supervision of the Gramme machines and electric lights	0 4·0	0 4·0	0 4·0	0 4·0	0 4·0	0 4·0	0 4·0	0 4·0
Total current expenses	0 7·0	1 2·5	0 10·0	1 7·0	1 1·0	1 11·5	1 4·0	2 4·0
Expenses of First Establishment.								
Engine	1 8·0	3 9·0	3 4·0	7 0·0	5 0·0	9 9·0	6 8·0	12 0·0
Gramme machines	1 3·0	1 3·0	2 6·0	2 6·0	3 9·0	3 9·0	5 0·0	5 0·0
Serrin regulators, conductors, &c.	0 10·0	0 10·0	1 8·0	1 8·0	2 6·0	2 6·0	3 4·0	3 4·0
Total expenses of first establishment	3 9·0	5 10 0	7 6·0	11 2·0	11 3·0	16 0·0	15 0·0	20 4·0
Interest and amortization, 10 per cent. per annum	0 5·0	0 7·0	0 9·0	1 1·4	1 1·5	1 7·2	1 6·0	2 0·4
Interest and amortization per hour of lighting, 1-500th	0 9·0	1 2·0	1 6·0	2 2·8	2 3·0	3 2·4	3 0·0	4 0·8
Current expenses per hour, brought down	0 7·0	1 2·5	0 10·0	1 7·0	1 1·0	1 11·5	1 4·0	2 4·0
Total cost per hour	1 4·0	2 4·5	2 4·0	3 9·8	3 4·0	5 1·9	4 4·0	6 4·8
Ratio of expenditure of fuel to total expenditure	0 0·56	0 0·84	0 0·64	0 1·04	0 0·68	0 1·17	0 0·69	0 1·25
Ditto of current expenses to total expenditure	0 4·37	0 5·08	0 3·57	0 1·15	0 3·25	0 3·80	0 3·07	0 3·64
Cost per lamp of 100 jets	1 4·00	2 4·50	1 2·00	1 10·90	3 7·30	1 8·60	1 1·00	1 7·20

TABLE *showing the Comparative Cost of the Two Modes of Lighting.*

	One Lamp.		Two Lamps.		Three Lamps.		Four Lamps.	
	Common Engine.	Special Engine.	Common Engine.	Special Engine.	Common Engine.	Special Engine.	Common Engine.	Special Engine.
Lighting by Electricity.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Current expenses	0 7·0	1 2·5	0 10·0	1 7·0	1 1·0	1 11·5	1 4·0	2 4·0
Interest and amortization	0 9·0	1 2·0	1 6·0	2 2·8	2 3·0	3 2·4	3 0·0	4 0·8
Total	1 4·0	2 4·5	2 4·0	3 9·8	3 4·0	5 1·9	4 4·0	6 4·8
Lighting by Gas.	*s. d.*		*s. d.*		*s. d.*		*s. d.*	
Current expenses	0 6·5		1 1·0		1 7·5		2 2·0	
Interest and amortization	0 1·6		0 3·2		0 4·8		0 6·4	
Total	0 8·1		1 4·2		2 0·3		2 8·4	

We shall only add a few summary observations upon these two tables.

As far as the electric light is concerned, the outlay for coal constitutes only a small portion of the total expenditure, being, in the eight cases successively examined, 6 and 8, 6 and 10, 7 and 12, and 7 and 13 per cent.

The cost of installation is more than double the amount of the current expenses. Yet we have only reckoned for a single steam-engine, whatever the number of lamps might be, as we have also assumed that only one Serrin regulator and one Gramme machine would be used for each lamp. Now, in most manufactories it would be imprudent not to do, at least partially, what has been done at the lighthouses of La Hève—viz., double the number of necessary engines and apparatus, in order to have a reserve in case of accident or repairs. But, on the other hand, the number of hours lighting yearly might exceed 500.

The expense is reduced almost to half when the Gramme machine can be driven by a powerful engine suitable for a manufactory. The reduction would be even greater with a hydraulic engine.

Estimated per lamp of 100 jets, the expense is naturally less when the number of lamps is increased; it is reduced in one case from 1fr. 60c. to 1fr. 30c. (1s. 4d. to 1s. 1d.), and from 2fr. 85c. to 1fr. 92c. (2s. 4·5d. to 1s. 7·2d.).

With regard to the corresponding cost of lighting by gas, it is in all cases 81c. (8·1d.) It varies from 28 per cent. of the other mode, according to circumstances, or about one-half less.

It may, however, be supposed (1) that the cost of production of the electric light might be reduced to 1 franc per lamp; (2) that the lighting arrangements to be carried out might supply the place of 25 gas-burners (instead of 20), at 4 centimes each. According to this double hypothesis the cost would be equal.

To sum up, the preceding details enable us to discuss this matter from two very different stand-points. Is it intended to produce light in considerable quantity and out of proportion with the ordinary requirements—at least with those actually in existence—of industry and civilization? Then electricity is incontestably more economical than gas. But if it is a question of fulfilling the conditions necessary and sufficient for good lighting, the question of cost, independently of many other considerations, can only in very exceptional cases be solved in favour of electricity.

As choice shall be made of the fanciful or the practical method of lighting, so, it appears to us, will the results be clearly shown by the figures we have given above.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

All iron trade matters remain very quiet indeed, and, on the whole, it is probable that there is less iron-making at the present time than for three or four months past. This remark is equally applicable to pig and finished iron branches, in both of which the current production is on a limited scale. In pig iron there have been few sales during the week, and those only in respect of foundry numbers of good Derbyshire and Yorkshire brands. Forge pig is not in much request, and the transactions in it have, of late, been on a very limited scale. The present prices for North Yorkshire pigs are about as under:—No. 1 foundry, 44s.; No. 2 foundry, 42s.; No. 3 foundry, 40s.; No. 4 foundry, 39s. 6d.; No. 4 forge, grey, 39s.; No. 5 forge, mottled, 38s. 6d.; No. 6 forge, white, 38s.; refined metal, 57s.; Kentledge, 42s. 6d.; cinder, 35s. net cash, or with slightly varying discounts for large lots. Hematite pigs remain firm, owing to the more general activity of the Bessemer steel branches. "Aireside Leeds," No. 1, is 52s.; No. 2, 48s.; No. 3, 46s.; No. 4, 55s.; forge, 44s.; M., 43s., and W., 43s.; "Acklam, Yorkshire," No. 1, 46s.; No. 2, 44s.; No. 3, 42s.; No. 4, 41s.; and forge, 40s. Special qualities for fine castings and cylinders, &c., range from £4 15s. to £5 5s. per ton f.o.r.

In merchant iron there is literally next to nothing doing, and prices are cut so low by the extreme competition of local and other manufacturers that there is in many instances no margin of profit on such goods as bars, &c. It may be asserted, indeed, that only such concerns as have their own ore, fuel, and blast furnaces are in a position to compete with any chance of success, and so as to secure a certain, even if small, profit.

There is only a moderate amount of business doing in the brassfoundry trade here and at Rotherham, although one or two houses are still in receipt of moderately good orders for water and gas fittings from companies, corporations, and plumbers.

The coal trade is not extremely active, but in several quarters the output is large and fairly maintained, particularly as regards Silkstones and other best household qualities. Some of these were advanced by 6d. to 1s. per ton on the 1st instant; but the advance was not general, nor is there any good ground for supposing that the winter will bring about any serious rise in prices. In one case, at least, slack coal is 6d. dearer this month, but this class of fuel cannot possibly become much more valuable until the iron and steel works shall have more orders on hand than at present. Coke is plentiful at 9s. to 14s. 6d. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is generally a stiffer tone in the market for the better classes of round coal. This, however, is attributable more to the anticipations of the coming winter demand, coupled with the existing extreme lowness of prices, than to any actual considerable increase in requirements at present. In the Manchester market the leading concerns have this month put 10d. per ton upon coal delivered to private consumers, and a general advance of 10d. has also been made upon burgy; but whether this latter advance can be maintained remains to be seen, as engine classes of fuel are still plentiful in the West Lancashire districts, and Wigan colliery proprietors will, no doubt, be induced to compete in the Manchester market, where the extra 10d. will probably allow them a margin to get in. In the districts immediately outside Manchester there has been a general readjustment of prices; in some places good common coal having been advanced 10d., and furnace coal, burgy, and slack 5d. per ton, whilst in other quarters reductions on late rates have been found necessary. In the West Lancashire districts there is no material change to notice. At some of the best coal collieries, where the owners are well supplied with orders, prices are firm at full list rates; but there is no upward movement in prices, and there are still low sellers in the market. Forge classes of coal continue very difficult to sell; supplies of burgy are in excess of the demand, and slack, notwithstanding the termination of the Bolton strike, is still a great drug in the market. The average quotations at the pit mouth may be given about as under:—Good Arley, 10s. to 11s. per ton; Pemberton four-feet, 8s. to 8s. 6d.; common coal, 6s. to 7s.; burgy, 5s. to 5s. 6d.; good ordinary slack, 4s. to 4s. 6d.; and inferior ditto, 2s. 9d. to 3s. 6d. per ton.

The shipping trade continues very dull, and beyond a few cargoes of special descriptions of fuel, there is little or nothing doing.

There is still no change for the better in the iron trade of this district and the action of sellers, in pushing iron upon the market which they have been unable to ship, causes a downward tendency in the price of outside brands of common iron, which, for prompt delivery, can now be bought at extremely low figures. Local makers of pig iron, however, notwithstanding that they are at present selling very little, continue firm at late rates, and for delivery into the Manchester district, No. 3 foundry cannot be bought for less than 51s., and No. 4 forge 50s. per ton, less 2½ per cent. For finished iron there is also very little demand, and local bars delivered into the Manchester district are offered at £6 10s. to £6 12s. 6d. per ton, whilst Middlesbrough bars can be bought for 2s. 6d. per ton less.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The coal trade, especially in gas and house, continues to improve in activity. A few more cargoes of gas coals have been sent to the United States by steamer. The freight is 5s. per ton to Boston and adjacent ports, and there are plenty of steamers ready to take out any quantity of coal of this description at that quotation. It seems pretty clear that by the fortunate coincidence of a large corn trade from America attracting steamers out, the gas companies of the eastern cities of the United States have been relieved of a considerable amount of anxiety with regard to the prospects of their stocks for the winter. To have been able to import British coals at so low a freight must have been a great boon. The price of gas coals on the Tyne remains at about 8s. best, 7s. medium, and 6s. 6d. the lower qualities. The shipments of gas coals to the South of England by steamers and sailing vessels have been a full average during the past six days. Loading turns at the shipping-places do no exceed three colliery working days. The house coal trade is in a pretty vigorous condition. Very best Wear house coals are quoted at from 12s. 6d. to 13s. 6d.; Tyne, 11s. 6d.; second-class house, 10s. 6d. to 11s. The steam coal trade was no worse last week than any time during October. The collieries, taking them as a whole, in this trade, are working from six to eight days per fortnight. The price of steam as really sold, and not as quoted in the market, is 11s. per ton best; seconds, 10s. to 10s. 6d.

There has been a very good supply of tonnage for coasting purposes. Little handy sailing vessels have been chartered pretty quickly at from 5s. 6d. to 6s. 6d. per ton, east coast; £8 to £8 10s. to English ports of the British Channel, and £8 10s. to £9 per keel to the northern ports of France, and £6 10s. steamers to Hamburg. Steamers begin to be taken out of the Baltic trade, and they are more abundant for coasting purposes. The rate to London may be quoted at from 4s. 6d. to 4s. 9d. per ton, steamers, with a fairly good demand.

A gale of wind blew on Monday, and the weather was unsettled until Wednesday, when there were heavy sailings of steamers and sailing ships to the south. The fleet of steamers having cleared out, an ordinary business has transpired since. But, upon the whole, November has opened with a good steady coasting trade in gas coal. Business remains pretty much as before reported. Where contracts were not made in the early part of the year the trade is done in the open market. This is likely to continue over Christmas.

The report of the state of the iron trade is very monotonous. There is no change either for better or worse. Ironmasters in Middlesbrough take a somewhat desponding view of the situation. The chemical trade has been dull during the past ten days.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The Hamilton Town Council have resolved on promoting an Improvement and Municipal Extension Bill in the ensuing session of Parliament, provided that no serious opposition is given to the scheme by persons of influence outside the present boundaries of the burgh. Amongst other things, they propose to supersede the present local Gas Act, on the ground that some of its provisions are more fitted for a company trading for profit, for which it was originally intended, than for the corporation, carrying on the works in the public interest. The report of the committee appointed to consider the subject suggests that increased powers should be taken for recovering arrears. It is also proposed that the provisions of the Police Act as to water supply should be incorporated with the present Water Acts, so as to provide a means of raising additional money without special powers, should that be found necessary in the future.

The directors of the Hawick Gaslight Company have just voted a sum of £10 towards the relief fund instituted in connection with the appalling disaster that lately occurred at High Blantyre Colliery.

On Thursday night, at the weekly meeting of the Wishaw Mutual Improvement Association, a lively and well-sustained debate took place on the question—"Ought the Police Commissioners to Purchase the Wishaw Gas-Works?" It may be remembered that the subject was up for consideration at a recent meeting of the commissioners, when it was resolved, for the first time, to adopt the provisions of the Burghs Gas Supply (Scotland) Act.

On Saturday, the 27th of October, a special general meeting of the Newport (Dundee) Gas Company was held for the purpose of confirming a resolution passed at a similar meeting held three weeks previously, to increase the capital of the company by the sum of £2700, in shares of £1 each, the first issue to be limited to 2000 shares, and the balance, or any part thereof, to be allocated by the directors when they consider it necessary to do so. The shares are to be allotted to the present shareholders *pro ratâ*, and paid by one instalment.

At a meeting of the Aberdeen Town Council held last Wednesday, there was submitted a very satisfactory statement regarding the gas accounts for the year. The following is a summary of the revenue and expenditure:—

Revenue.

By Gas and meter rents		£43,571	1 1½
Residual products—			
Coke	£657 14 8		
Tar and ammoniacal liquor	3271 4 2		
		3928	18 10
Transfer fees		8	6 6
		£47,508	6 5½

Expenditure.

To Manufacture of gas		£31,034	13 6
Distribution of gas		1,336	7 6
Rents, rates, and taxes		1,122	2 7
Management		907	1 6
Discount on gas and bad debts		880	16 5½
Amount transferred to depreciation, including £650 to contingent-fund		1,341	4 10
		£36,622	6 4½
Balance to meet annuities and interest		10,886	0 1
		£47,508	6 5½

The payments to the account of annuities amounted to £8069 0s. 9d., leaving a balance of £3459 19s. 9½d. as the surplus for the year. In submitting the report of the Gas Committee, Bailie Donald referred to the surplus of revenue over expenditure—a surplus which had enabled them to recommend the council to reduce the price of gas 2d. per 1000 cubic feet, or from 4s. 7d. to 4s. 5d. The recommendation was agreed to, and it was also resolved that the reduction should count over the half year now past. The price of the gas for the street-lamps was reduced from 4s. 4d. to 3s. 3d. per 1000 cubic feet. On the price of the gas to the ordinary consumers, a reduction of 1s. per 1000 feet has been made during the six years that the management of the gas-works has been in the hands of the town council.

Again, there is a further improvement to note in the illuminating power of the Glasgow gas. Dr. Wallace's report for the week ending the 27th ultimo shows that the minimum illuminating power was in no case below 26·30, while the average ranged, over the four testing-stations, from 27·03 candles to 28·52 candles, and the maximum from 27·60 candles to 28·92 candles.

The results of Mr. J. Falconer King's gas analyses were submitted to the Town Council of Edinburgh at a meeting held last Tuesday. They showed the illuminating power of the Edinburgh Company's gas to be 27·10 candles, and that of the Leith Company to be 26 candles.

On Monday, the 27th ultimo, the buildings and site of the defunct Denny Joint-Stock Gas Company's works were exposed for sale by public auction. The upset price was £200, and after some spirited bidding were secured for £300.

The public lamps of Whithorn have not yet been lighted this season, in consequence of the town council and gas company being unable to make a satisfactory arrangement as to the payment to be made for the gas consumed.

The case of *Edington and Others v. the Dundee Water Commissioners* was again under consideration in the Court of Session last Friday, a debate taking place before Lord Curriehill on the question of expenses. On the part of the pursuers it was urged that, as they had gained a substantial success, they were clearly entitled to expenses. At the conclusion of the debate, Lord Curriehill expressed his agreement with the arguments of the counsel for the pursuers, but he would express no opinion at all as to the extent of the modification which should be made in the expenses claimed, until he had seen the accounts.

A certain amount of steadiness has been shown during the past week in the Glasgow pig iron market, and without any marked downward movement to record. There has been a good business done, and a fair amount of investment is noticeable, but it has been well met by sellers, who anticipate still lower prices. Shipping iron remains dull, with only a limited amount of business; manufactured continues unchanged. The closing

business was done on Friday at 52s. 1d., eight days, sellers remaining at at 52s. 4d., one month, buyers offering 1d. less per ton.

It is several years since the Glasgow coal market was in so dull and inanimate a condition as at present. House descriptions of coal are much pushed, and prices are a turn cheaper. Local trade shows no signs of improvement.

THE NEW GAS-WORKS AT BILSTON.—In the paragraph respecting these works, which was copied from the *Wolverhampton Chronicle* into our last number, the fact was omitted that the station-meter, to pass 30,000 cubic feet of gas per hour, was constructed by the Gas-Meter Company, of London.

QUALITY OF THE BIRMINGHAM GAS.—Mr. T. Jackson reports that during the month of October, at the four gas-making stations of the corporation, he made 16 examinations of the illuminating power of the gas supplied to the borough. The maximum light in sperm candles was 19·67; minimum, 16·64; average, 17·44. The parliamentary standard is 15 candles with Sugg's No. 1 "London" burner.

TAUNTON WATER-WORKS COMPANY.—The last meeting of this company was held on the 29th ult. A resolution for the voluntary winding-up of the company, passed at a previous meeting, was confirmed, and Messrs. H. Badcock, H. Turle, O. G. Walter, R. Barnicott, and Dr. Kelly, directors, were appointed liquidators of the affairs of the company, and £100 was voted to them for services they might render. The shareholders were congratulated upon the bargain they had made in disposing of their works to the town council, and it was also stated that the council were quite satisfied with the bargain.

WALSALL CORPORATION NEW GAS-WORKS.—The gas-works at Walsall, which have been in course of erection at the Pleck for some months, have during the past week begun to contribute to the supply of the town, although in several details they are not yet complete. The buildings consist of a retort-house 180 feet long by 118 feet wide, and 20 feet high to the wall-plates, with large coal-sheds along the sides, and a chimney-stack in connection, 150 feet high and 5 feet square; and engine and exhauster house, with boiler-house adjacent, and tanks capable of storing 80,000 gallons of tar and ammoniacal liquor; a purifying-house 123 feet 6 inches long by 57 feet wide and 18 feet high to the wall-plate; a governor-house and meter; a gasholder of 120 feet diameter, with 52 feet rise, and capable of storing 580,000 cubic feet of gas; and a canal basin for 16 boats. The gas is conducted by a 20-inch main to Bescot, where it enters the main and supply-pipes formerly the property of the Birmingham and Staffordshire Gas Company. A railway siding and a line of rails from the siding to the retort-house has yet to be made to complete the works, and much labour will have to be bestowed upon the ground within the boundary walls of the concern. The total cost of the works up to the present time is about £40,000, and it is estimated that they are capable of producing 125 million cubic feet of gas per annum, being 25 millions more than the average of the old works in Wolverhampton Lane for the last seven years. Consequently the joint produce of the two works will put the corporation in possession of a yield of 225 million cubic feet of gas, with facilities at the new works for an extension of the yield as the requirements of the town may render it necessary.—*Birmingham Daily Post.*

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

3980.—QUAGLIO, J. VON, Stockholm, Sweden, "Improvements in purifying coal gas from bisulphide of carbon and other sulphur compounds." Oct. 27, 1877.

3991.—YULE, J. R., Porten Road, London, "Improvements in the construction of sewage outfalls." Oct. 29. 1877.

3992.—WIRTH, F., Frankfort-on-the-Maine, Germany, "Improvements in apparatus for and in the treatment of ammoniacal liquids." A communication. Oct. 29, 1877.

4012.—OUTRIDGE, J. E., Egham, Surrey, "Improvements connected with steam and other engines and pumps." Oct. 29, 1877.

4028.—HUGHES, E. T., Chancery Lane, London, "Improvements in pumps." A communication. Oct. 30, 1877.

4052.—WEYHE, W., Bremen, Germany, "Improvements in gas-motor engines." (Complete specification.) Nov. 1, 1877.

4067.—BROCK, G., Vienna, Austria, "An apparatus for lighting railway carriages and vessels with compressed gas." Nov. 1, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1426.—PRICE, W. E., Hampton Wick, London, "Improvements in screens or sifters." April 12, 1877.

1619.—SYNGE, M. H., Pall Mall, London, "Improved apparatus for filtering and purifying sewage." April 25, 1877.

1632.—WEATHERHOGG, G. W., Camberwell, London, "Improvements in apparatus for carburetting atmospheric air." April 26, 1877.

1644.—CUTLER, S., Millwall, London, "Improvements in apparatus used in the purification of gas." April 27, 1877.

1645.—MORRIS, F., Brentford, and CUTLER, S., Millwall, London, "Improvements in gas-condensers." April 27, 1877.

1698.—LIDDON, J. J., Islington, and SIMMONDS, F. H., Goswell Road, London, "Improved valve-cocks or taps." May 1, 1877.

1734.—EYTON, W. C., Weston, Herts, "Improvements in pressure and vacuum gauges." May 4, 1877.

1764.—WESTINGHOUSE, G., jun., Pennsylvania, U.S.A., "Improvements in and in apparatus for lighting railway carriages." Partly a communication. May 7, 1877.

1774.—BURBIDGE, T., Penge, Surrey, "Improvements in valves for regulating or controlling the supply and discharge of water or orher fluids." May 7, 1877.

1805.—DÜLKEN, A., Düsseldorf, Prussia, "A new mode of constructing water-meters, capable of serving at the same time as prime movers." May 9, 1877.

1822.—MILNE, J., Edinburgh, N.B., "Improved appliances to railway and tramway carriage gasholders, whereby they may be automatically charged." May 10, 1877.

2095.—CLARK, A. M., Chancery Lane, London, "Improvements in valve apparatus for lavatory and water-closet basins, baths, and other similar uses." A communication. May 29, 1877.

2116.—BRADSHAW, A., Accrington, Lancs, "Improvements in the construction of pressure-gauges." May 31, 1877.

2231.—BAGSHAW, J. and W., Batley, York, "An improved equilibrium valve for water and other fluids." June 8, 1877.

2716.—ORTMANS, V. C. J., Brussels, Belgium, "An improved rotatory pump or apparatus for raising and forcing fluids; applicable also as a motive-power engine, and for other purposes." July 14, 1877.

2860.—KIDD, J. and J., Wandsworth, London, "Improvements in means and apparatus for applying heavy oils to illuminating purposes." July 26, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3504.—KÖRTING, E., "Improvements in the mode of and apparatus for elevating or otherwise impelling matters or materials for various useful purposes." Oct. 12, 1874.

3505.—KÖRTING, E., "Improvements in the mode of and apparatus for ventilating, cooling, drying, and distilling." Oct. 12, 1874.

3525.—KIRTLEY, J. G., "An improved filtering apparatus, especially adapted for domestic and ships use." Oct. 14, 1874.

3567.—ASHWORTH, G. and E., "Improvements in steam-pumps or pumping-engines." Oct. 17, 1874.

3611.—LACK, P. J., "Improvements in valves for regulating the supply of gas, and in other fittings connected with gas-burners." Oct. 28, 1874.

3699.—HAMBLETON, F. H., "Improvements in apparatus to admit of the continuous running of a pump or other apparatus supplying fluid through pipes when the flow through the pipes is for a time wholly or in part arrested, without injury to the pipes and without waste of fluid." Oct. 26, 1874.

3719.—PAGET, F. A., "Improvements in centrifugal pumps for raising and forcing liquids, and in centrifugal pumps or fans for exhausting and blowing gases." Oct. 27, 1874.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

2730.—STALVIES, J., "Improvements in gas-stoves for heating and warming rooms, and for other like purposes." Oct. 17, 1870.

Share List of Metropolitan Gas and Water Companies.

(*Corrected by Mr.* F. N. GOLDING, *Sun Court, Cornhill, from the latest Stock Exchange Quotations.*)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
	£	GAS COMPANIES.	£ s. d	£ s. d	£
10000	20	Anglo-Romano . .	20 0 0	9 0 0	20–21
5000	20	Bahia (Limited) . .	20 0 0	2 0 0	10–12
1000	20	Do., do., redeem.	20 0 0	7 10 0	..
1500	20	Do., 2nd pref. . .	20 0 0	7 10 0	..
40000	5	Bombay (Limited) .	5 0 0	7 10 0	..
10000	5	Do., fourth issue.	4 0 0	7 0 0	5–5⅛
14000	20	British (Limited) .	20 0 0	10 0 0	40–42
7500	20	Cagliari (Limited).	20 0 0	5 0 0	15¼–16⅛
550000*l.*	Sk.	*Commercial*	100 0 0	10 0 0	191–196
70000	100	Do., 7 per cent. .	..	..	138–142
20000	20	Continental Union.	20 0 0	6 0 0	19¼–20½
20000	20	Do., new	12 10 0	6 0 0	½ds–¼pm
10000	20	Do., preference .	20 0 0	7 0 0	25–27
75000	8k.	*Crystal Palace District*	100 0 0	10 0 0	197–202
125000	8k.	Do., 7 per cent. .	100 0 0	7 0 0	145–150
50000	8k.	Do., preference .	100 0 0	6 0 0	138–142
23406	10	European(Limited)	10 0 0	10 0 0	17–18
12000	10	Do., new shares.	7 10 0	10 0 0	6–7pm.
35406	10	Do., new shares .	5 0 0	10 0 0	3¼–4¼pm
4094840*l.*	Sk.	*Gaslight & Coke* A.	100 0 0	10 0 0	192–195
1000000*l.*	Sk.	Do. B.	100 0 0	4 0 0	85–90
50000	10	Do. 5 per ct. pref. conv., 4th issue.	10 0 0	5 0 0	7–8pm.
50000	10	Do. do., 5th do. .	2 0 0	5 0 0	6–7pm.
2000000*l.*	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	210–220
300000*l.*	,,	Do. D do. do. .	100 0 0	10 0 0	210–220
165000*l.*	,,	Do. E do. do. .	100 0 0	10 0 0	210–220
30000*l.*	,,	Do. F 5 do. do. .	100 0 0	5 0 0	105–110
60000*l.*	,,	Do. G 7½ do. do. .	100 0 0	7 10 0	150–160
1300000*l.*	,,	Do. H	100 0 0	7 0 0	140–144
6200	5	Georgetown,Guiana	5 0 0	5 0 0	..
5000	10	Hong Kong (Lim.)	10 0 0	10 0 0	18–20
56000	50	*Imprl. Continental*	43 15 0	9 10 0	94–96
383000*l.*	Sk.	*London*	100 0 0	10 0 0	190–195
1500000*l.*	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	135–140
14450	Sk.	Do., 2nd pref. . .	100 0 0	6 0 0	120–130
4350	Sk.	Do., 3rd pref. . .	100 0 0	6 0 0	120–130
7622	25	Do., A shares . .	25 0 0	6 0 0	31–33
26805*l.*	All	Do., Debent. stk.	100 0 0	5*l.* & 6*l.*	..
15000	5	Malta and Mediterranean (Limited).	5 0 0	2 0 0	2–3
6000	5	Do., preference .	5 0 0	7 10 0	5–5⅛
8000	10	Nietheroy, Brazil (Limited)	10 0 0	5 0 0	..
30000	5	Oriental (Calcutta).	5 0 0	9 10 0	7–7¼
30000	5	Do., new shares .	3 0 0	9 10 0	1¼–2pm.
10000	5	Ottoman (Limited).	5 0 0	3 0 0	2–3
10000	10	Pará (Limited) . .	10 0 0	2 0 0	4⅛–5⅛
27000	20	*Phœnix*	20 0 0	10 0 0	38–40
3600000*l.*	100	Do., new	60 0 0	7 10 0	102–107
1440000*l.*	8k.	Do., capitalized .	100 0 0	5 0 0	100–105
		Do., new, 1876. .	..	..	16-17pm
37500	20	Rio de Janeiro (L.)	20 0 0	10 0 0	30–32
7359	5	Singapore(Limited)	5 0 0	7 10 0	5⅛–5⅜
2000	5	Do., preference .	5 0 0	7 10 0	5⅜–6½
1500	32½	Shanghai	32 10 0	12 0 0	30–32
4000	50	*South Metropolitan*	50 0 0	11 0 0	107–110
4000	12½	Do.	12 10 0	10 0 0	25–27
20000	12½	Do., new shares .	10 10 0	10 0 0	12¼–13⅛
15000	10	*Surrey Consumers.*	10 0 0	10 0 0	18–19½
10000	10	Do., new	8 0 0	10 0 0	7–8
9000	4	United General . .	4 0 0	2 10 0	3–3⅛
1500	10	*Wandsw. & Putney*	10 0 0	10 0 0	19–20
1500	10	Do.	10 0 0	7 10 0	11–12
2957	10	Do.	10 0 0	7 0 0	..
993	10	Do.	3 0 0	7 0 0	..
26000	5	*West Ham*	5 0 0	10 0 0	9–10
		WATER COMPANIES.			
12000	100	Chelsea	100 0 0	6 0 0	143–146
1800000	100	East London . . .	100 0 0	6 0 0	146–149
8000	50	Grand Junction . .	50 0 0	5 0 0	75–78
5840	25	Do., ¼ shares . .	25 0 0	5 0 0	37–39
2160	25	Do., new ditto; max. div.,7½ p.c.	25 0 0	5 0 0	32–33
547960	100	Kent	100 0 0	8 0 0	198–203
970	100	Lambeth	100 0 0	6 5 0	145–147
1161	100	Do., max.,7½ p.c.	100 0 0	6 5 0	142–145
442	100	New River	100 0 0	7 0 0	320–350
4475	100	Do.	85 0 0	7 0 0	280–300
400000	100	Do.,deb. sk.,4 p.c.	100 0 0	4 0 0	103–105
3036	100	Southwrk. & Vauxh.	100 0 0	4 0 0	101–104
1296	100	Do., pref. stock .	100 0 0	5 0 0	110–112
..	100	Do., D shares . .	100 0 0	4 0 0	100–102
..	..	Do., 4½ preference	100 0 0	4 10 0	104–106
..	100	Do., new ordinary	..	4 10 0	..
1600	100	Do., new ord. No.1	40 0 0	4 10 0	..
12172	61	West Middlesex . .	61 0 0	6*l.* p.sh.	135–138

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
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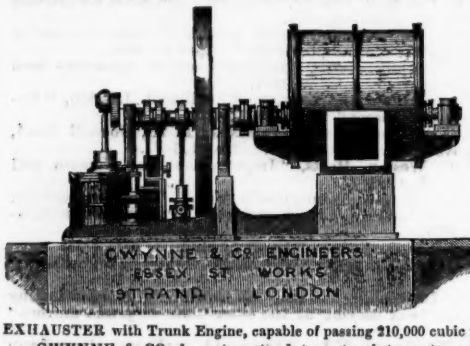

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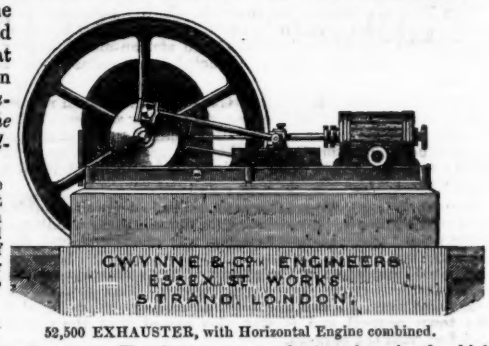
GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



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Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

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WANTED, the Address of Gas Companies who have not received a Copy of the New Edition of PAMPHLET for GAS COMPANIES to distribute to their Gas Consumers—"Cooking and Heating by Gas." Price £6 for first thousand. Copies by post Threepence—direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

WANTED, by a Young Man, the son of a Gas Engineer, a situation as ASSISTANT in a large Gas-Work, or as Manager of a smaller one. Is a good draughtsman, has a knowledge of chemistry, and is quite competent to take charge of a work. Can be well recommended.
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WANTED, for a Foreign Gas-Works, a WORKING FOREMAN familiar with the routine of gas-making, service and main laying, and gas-fitting. He must write a good hand, and be capable of taking charge of the works during the absence of the manager. Wages £3 per week. A young man preferred.
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WANTED, by the above Company, a respectable person as METER INSPECTOR. One who can repair meters preferred. Salary 25s. per week, with house.
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ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.
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FOR SALE—The Robertsbridge Gas-Works, situate about half way between Tunbridge Wells and Hastings. The annual sale is about 750,000 cubic feet.
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GAS PLANT FOR SALE, suitable for Small Works:—
Seventeen 4-inch and 3-inch H-Pipes.
Eighteen 15-inch Circular Mouthpieces.
A 6-inch Governor.
A Station-Meter, to pass 6000 cubic feet per hour.
Scrubber and Washer combined; very good.
Vertical Condenser; very good.
Seven 7-feet lengths, 12-inch D-shaped Hydraulic Main.
Two Gasholders, each capable of holding 15,000 cubic feet.
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GASHOLDER FOR SALE.

ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Piggott and Co., of Birmingham.
To be seen at work at the Gas-Works, Birkenhead.
Cause of removal to make room for extensions.
To be sold a bargain, taken down, and re-erected ready for work.
For particulars, apply to Messrs. ASHMORE AND WHILE, STOCKTON-ON-TEES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

TO GASHOLDER MAKERS.

THE Buxton Local Board invite Tenders for a TELESCOPE GASHOLDER, 80 feet diameter, to be erected at their new works, Ashwood Dale, Buxton.
Plans and specifications may be seen at the Gas-Works, Buxton, and at the Offices of Mr. Henry Lyon, Engineer, Barton House, Deansgate, Manchester.
Tenders, endorsed "Gasholder," addressed to the Chairman, to be sent in on or before the 13th of November next.
The Board do not bind themselves to accept the lowest or any tender.
By order of the Board,
JOSIAH TAYLOR, Clerk.
Local Board Office, Buxton, Oct. 26, 1877.

TO GAS COMPANIES.

WE beg to call attention to our Im- PROVED STREET-LAMP REGULATORS with brass cones and burners. Sample, 3s.; carriage paid. Special Steatite Burners for Street-Lamps, 8s. per gross. Quotations for quantities. Street-Lamp Regulators, Wet and Dry Meters repaired.
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NOTICE.

THE GAS & WATER COMPANIES DIRECTORY, 1878.

(GAS SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

CHARLES W. HASTINGS,

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General Ironfounders and Makers

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N.B.—All Communications to be addressed to the FIRM ONLY.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

NOTICE FOR LOAN.

THE Directors of the Borough of Portsmouth Water-Works Company are prepared to receive on Loan £5000 at 4 per cent., for a fixed term of Five, Seven, or Ten Years, either in one sum, or in sums of not less than £250 each. Interest coupons are issued with the mortgage securities.

Offers can be addressed to the Secretary on or before Thursday, the 15th day of November, 1877, marked "Offer of Loan."

Principals to apply.

By order of the Board,

R. W. FORD, Secretary.

Nov. 1, 1877.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is hereby given that the HALF-YEARLY ORDINARY MEETING of the PROPRIETORS of the Imperial Continental Gas Association will be held at the City Terminus Hotel, Cannon Street, London, on TUESDAY, the 27th inst., at Two o'clock in the afternoon precisely, when a Report will be made to the Proprietors, a Dividend declared for the half year ended the 30th of June, 1877, and the usual ordinary business of such meeting transacted.

Notice is also hereby given, that the Transfer Books and the Register of Shareholders will be closed on Tuesday, the 13th inst., and will remain closed until after the half-yearly ordinary meeting on the 27th inst.

ALBERT F. JACKSON, Secretary.

By order of the Board.

No. 30, Clement's Lane, Lombard Street, London, Nov. 5, 1877.

MICHAEL & WILL'S GAS AND WATER SUPPLY.

This day is published, second edition, 8vo., 25s., cloth,

THE LAW RELATING TO GAS AND WATER: comprising the Rights and Duties, as well of Local Authorities as of Private Companies, in regard thereto, and including all Legislation to the close of the last Session of Parliament. Second Edition. By W. H. MICHAEL and J. SHIRESS WILL, of the Middle Temple, Esqs., Barristers-at-Law.

London: BUTTERWORTHS, 7, FLEET STREET, Her Majesty's Law Publishers.

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A full Report of the Evidence given before the Select Committee of the House of Commons on the Bills of The Gaslight and Coke Company and the Crystal Palace District Gas Company in the present Session.

LONDON:

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, E.C.

REMOVAL.

CHARLES HEISCH, F.C.S., Analytical and Consulting Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

A. FAIRLIE WILSON,

CONSULTING GAS ENGINEER,

34, ST. GEORGE'S ROAD, SOUTHWARK, S.E.

Reports and Valuations in the Management, Construction, and Structural Value of Gas-Works.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 23, Great George Street, WESTMINSTER.

TO GAS ENGINEERS, MANAGERS, &c.

HILL and CO., Gas Engineers and Architects, 11, Appach Road, Brixton Rise, S.W., prepare Designs for the construction of New Gas-Works, Bridges, and Roofs, or for the remodelling and extension of existing Works. Also provide Drawings of all kinds of Gas Apparatus and Plant. Drawings, Tracings, and Specifications copied for Engineers and Contractors.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. Guest and Chrimes, Rotherham.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. Guest and Chrimes, Foundry and Brass Works, Rotherham.

CATHELS'S Improved Retort-Settings. Guaranteed to heat and wear well, with great economy of Fuel.

Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.

Apply to Mr. Thos. Newbiggino, Consulting Gas Engineer, 5, Norfolk Street, Manchester.

GARSIDE'S IMPROVED MAIN DRILLING CLIP.

No. 1 takes from 2-in. to 6-in. Mains.
No. 2 takes from 6-in. to 12-in. Mains.

GARSIDE'S REGISTERED TUBE-VICE takes ¾ brass to a 2-in. Socket.

May be had direct from the maker, Samuel Garside, Gatefield Iron-Works, Ashton-under-Lyne.

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MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,
SCOTSWOOD FIRE-BRICK WORKS,
SCOTSWOOD-ON-TYNE.

BOUCK & CO., LIMITED,
TAR DISTILLERS & MANUFACTURING CHEMISTS,
MILES PLATTING, MANCHESTER.

BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

HOPKINS, GILKES, & CO.,
Limited,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
London Office: 25, Laurence Pountney Lane.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

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GAS-WORKS TAKEN ON LEASE.

Mr. Romans has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

Analysis and Prices forwarded on Application.

GAS COMPANIES
AND
LOCAL BOARDS
Requiring New Street-Lamps are recommended
A **KEEN'S PATENT**
DOUBLE-CLIP
STREET-LAMP.
A great improvement on the old-fashioned 14-in. Lamps.
They have been sold to various Gas-Works throughout
B the country and abroad, and the highest satisfactory testimonials are given as to their superiority.
For particulars of price, &c., apply to
WILLIAM KEEN, Sole Proprietor
and Manufacturer, Robertson Street, HASTINGS.

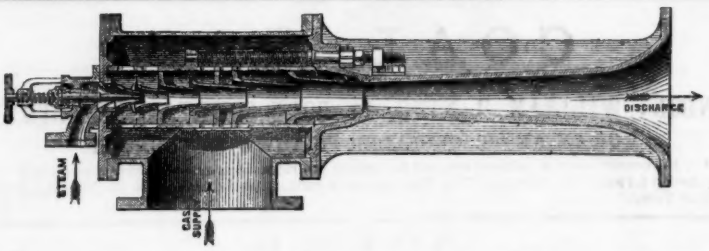
ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.

A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, Gas and Hydraulic Engineer,
CHARLES HENRY STREET AND BISSELL STREET, BIRMINGHAM.



KÖRTING'S STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

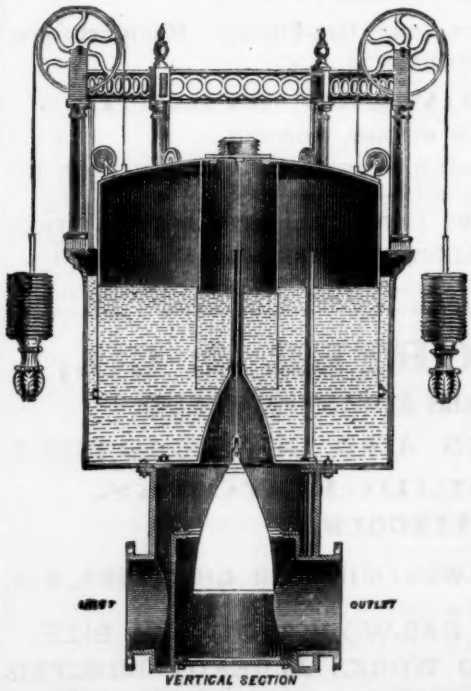
KÖRTING BROS.,
17, LANCASTER AVENUE, MANCHESTER,
OR TO
GERALD J. TUPP, 8, John Street, Adelphi, W.C.,
LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

J. & J. BRADDOCK,
GLOBE METER-WORKS,
OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

GAS PURIFICATION.

BAILES & HALLSWORTH,

CONTRACTORS FOR THE

PURIFICATION OF COAL GAS,

BY THEIR

PATENT OXIDE OF IRON COMPOUND.

The material is in use at most of the principal Gas-Works in Yorkshire and elsewhere. It contains considerably less moisture than natural Oxide of Iron. It is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

FOR SAMPLES AND TERMS, ADDRESS—

BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY, LEEDS.

ALFRED LASS,

SPECIAL ACCOUNTANT FOR GAS COMPANIES,

30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.

The above forms are registered.

Water Companies Accounts also prepared and adjusted.

CONSULTATIONS.

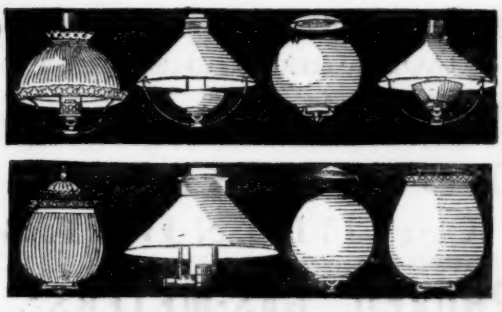
ZIMMERMANN & CO.,

21, RED LION SQUARE,

HOLBORN, LONDON.

WORKS: HANAU, PRUSSIA.

FOREIGN GAS-FITTINGS.



APPLY FOR PATTERN BOOKS.

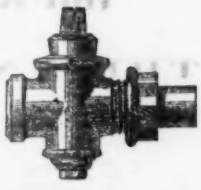
LAMBERT'S

CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:

SHORT STREET, LAMBETH, LONDON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

(Successors to JOHN WILLIAM O'NEILL & CO.,)

Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,

CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL,
SAMUEL H. JOHNSON, } Joint Managing Directors.

WILLEY & COMPANY,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

☞ PLEASE NOTE THE ADDRESS—

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THE WIGAN COAL & IRON COMPANY,

LIMITED.

DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

ALDER AND MACKAY,

GRANGE WORKS, EDINBURGH,

MANUFACTURERS OF

CONSUMERS IMPROVED GAS-METERS;

IMPROVED DRY GAS-METERS, in Cast-Iron and Tin Cases,

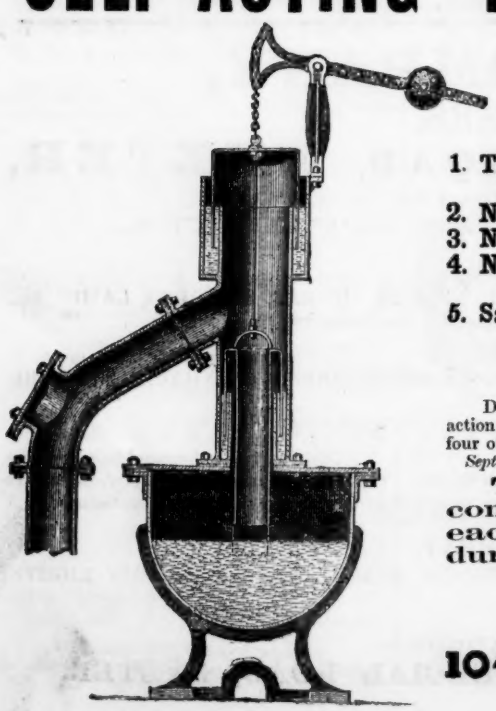
OF THE HIGHEST EXCELLENCE,

Warranted to measure correctly, and not to vary.

STATION METERS AND GOVERNORS,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c.

SELF-ACTING REMOVABLE DIP-PIPE,



PATENTED BY

CHANDLER & STEVENSON.

ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

Testimonial from the Proprietor of the Apeldorn Gas-Works.

DEAR SIR,—In reply to your inquiry, the Self-Acting Dip-Pipes, which have been in action at my works for two years, give entire satisfaction. I forward you order for four others.

Yours truly,

Sept. 9, 1877. R. BAKKER.

These Dip-Pipes can now be supplied complete, except the flanched bend, for £4 each, which includes the charge for licence during the whole term of the patent.

APPLICATIONS TO BE MADE TO

Messrs. CHANDLER & SONS,

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Who fix the Dip-Pipes, at a small Charge, when required.

JOHN ABBOT & CO., LIMITED,

MANUFACTURERS OF

IMPROVED

HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS.

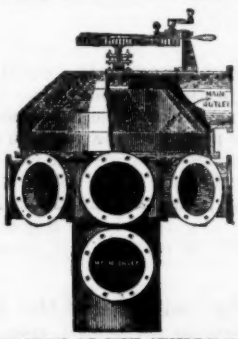
GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,

PARK WORKS, GATESHEAD.

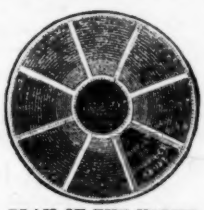
LONDON OFFICES: 2, SUFFOLK LANE, CANNON STREET, E.C.

GLASGOW OFFICES: 54, ST. ENOCH'S SQUARE.

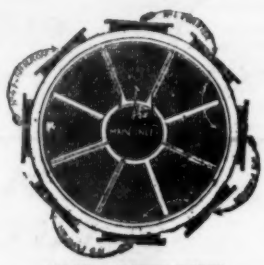
C. & W. WALKERS'
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

THOMAS ALLAN & SONS,

IRONFOUNDERS,

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 7 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

London Agent: Mr. A. C. FRASER, ST. STEPHEN'S CHAMBERS, TELEGRAPH STREET.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re- quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS VESTIBULE LAMPS, AND THE PATENT CRYSTAL ILLUMINATION.

A LARGE STOCK ALWAYS IN HAND OF

IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,

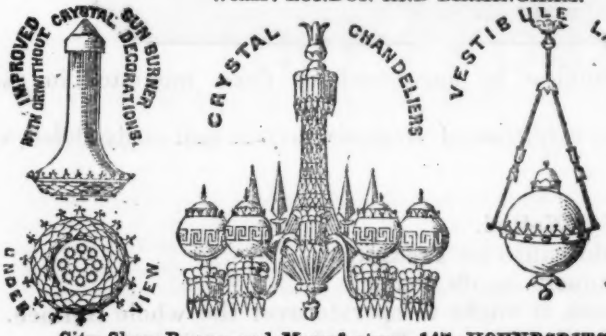
AND EVERY DESCRIPTION OF

GAS AND WATER FITTINGS.

THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.

STREET LAMPS AND COLUMNS IN GREAT VARIETY.

WORKS: LONDON AND BIRMINGHAM.



GAS MOONS,
Cut and Engraved, of the newest designs

GAS REFLECTORS
In Silver and Glass

GAS NIBS AND BURNERS
Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

ESTABLISHED 1830.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,

148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

SOLE AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

NOTICE OF REMOVAL.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

Begs to intimate to his numerous connexion that, for the convenience of Gas Managers and others waiting upon him, he has removed from

89, HIGH STREET, STOURBRIDGE,

and that in future his HEAD OFFICES will be

123, NEW STREET, BIRMINGHAM,

Where all communications and inquiries should be addressed.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

MESSRS. WILSON CARTER & PEARSON, being contractors to several of the principal Gas Companies in the Midland Counties, have pleasure in being enabled to give them as references.

Chief Offices: Temple Buildings, 50, New Street, Birmingham.

London Offices: 6, Great Winchester St. Buildings, E.C.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9865 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

ADDISON POTTER,

WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of

CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

LANCASHIRE.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

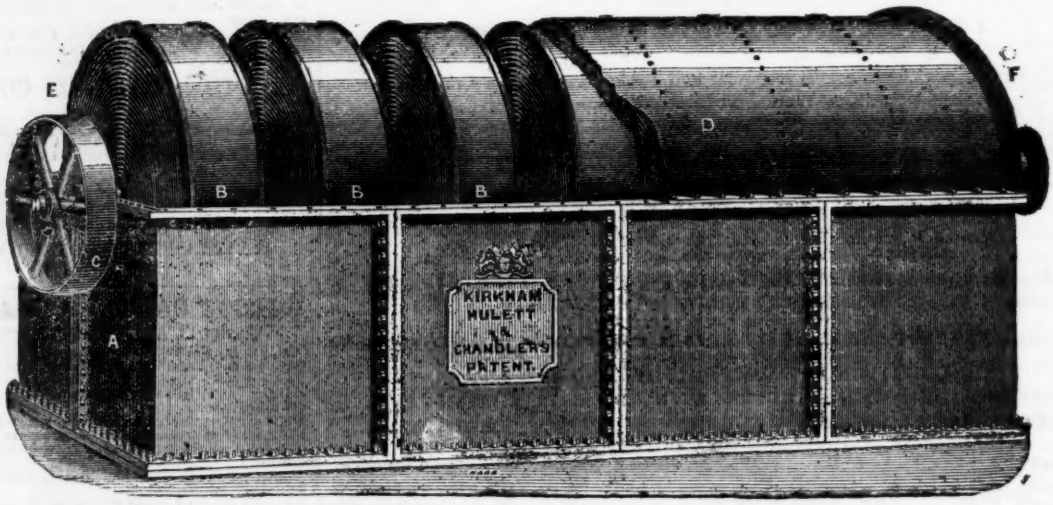
London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

STANDARD WASHER AND SCRUBBER.



The advantages of the Apparatus will doubtless be understood by those interested in gas manufacture.

The principal points of any Apparatus for the extraction of ammonia may be summarily stated as follows:—

1. **A large amount of Surface is desirable.**
2. **Such Surface should be always effectually Wetted.**
3. **The Surfaces or Scrubbing Material should cause no Pressure.**
4. **The Gas should meet various strength Liquors on its course.**
5. **However small the quantity of Water used, it ought to operate over the whole Surface.**
6. **Changing Scrubbing Material is both Objectionable and Expensive.**
7. **Economy both as to Space occupied and Cost of Apparatus is an important item.**

All these requisitions are supplied by the above Apparatus, of which the following is an explanation:—

A is a cast-iron tank, formed into several separate water-tight compartments.

B B B volutes of sheet iron fitted to the centre shaft, which is driven by the pulley, C, and causing the said volutes to revolve each in a separate compartment filled with water or other fluid.

D, the cover, has partitions fitted into it corresponding with those in the tank, sufficient space being left between the top of the partition in the tank and the lower edge of that in the cover, to allow the gas a free passage through the first volute to the second, and so on to the third, fourth, &c.

The action is as follows:—The crude gas entering at E is partly washed in the first compartment, which becomes 10 or 12 oz. liquor, or stronger if required, according to the quantity allowed to enter per ton; the gas then passes to the second, where the liquor is of a less strength; thence into a weaker liquor, as it passes from one compartment to the other, finishing at the last compartment or outlet, F, with clean water, which is constantly flowing and running over from one compartment to another, until it reaches the last space, from which it flows from the outlet-pipe into the well or tank ready for sale or removal.

Taps are inserted in each compartment for the convenience of drawing liquor for testing, &c.

Applications as to Cost, &c., may be obtained of either

Mr. D. HULETT, 55 & 56, HIGH HOLBORN;

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER;

Or Messrs. CHANDLER, 104, NEWINGTON CAUSEWAY.

Inquirers will please state their Maximum Day Make.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES
OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

EDWARD COCKEY & SONS,

GAS ENGINEERS, FROME SELWOOD,

MANUFACTURERS OF ALL DESCRIPTIONS OF

APPARATUS CONNECTED WITH GAS-WORKS.

THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE

DRY-FACED VALVES

FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"Warrington Gaslight and Coke Company.
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

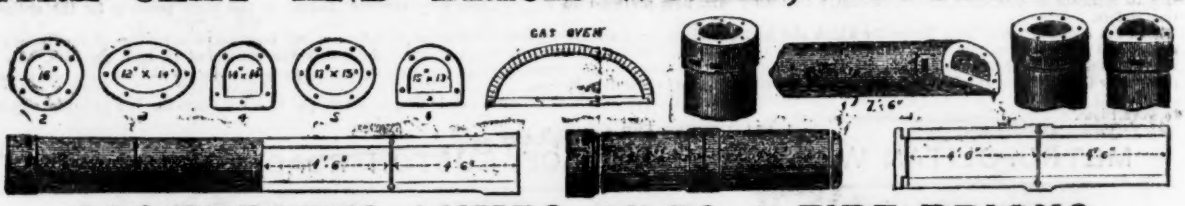
The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON.

HARRIS & PEARSON,

FIRE-CLAY AND BRICK WORKS, STOURBRIDGE.

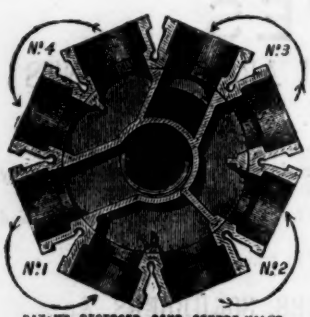


GAS-RETORTS, LUMPS, TILES, & FIRE-BRICKS,

OF EVERY DESCRIPTION.

A LARGE ASSORTMENT OF GAS-RETORTS IN STOCK.

STOCK FOR EXPORT READY AT THE WORKS, AND AT ELLESMERE PORT.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

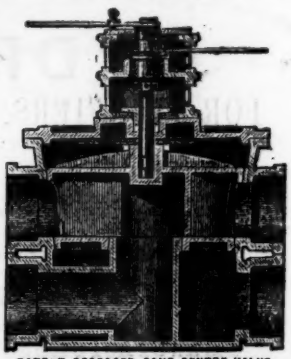
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

LONDON OFFICE: 106, CANNON STREET.

D. HULETT & CO.

Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
Also made **EXTRA STOUT** recommended for its durability, PRICE 11s. 6d. each.

D. HULETT'S IMPROVED SERVICE CLEANSER,

By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

HULETT'S PATENT MERCURIAL REGULATOR,

For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

PATENTEES OF IMPROVED WET AND DRY GAS-METERS.

Makers of all kinds of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

GAS HEATING AND COOKING STOVES.

55 and 56, HIGH HOLBORN, LONDON.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co. 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Nov. 6, 1877.